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Economic Development in Pakistan†

By JEROME B. COHEN*

Fourth, we must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas. More than half the people of the world are living in conditions approaching misery. Their food is inadequate. They are victims of disease. Their economic life is primitive and stagnant. Their poverty is a handicap and a threat both to them and to more prosperous areas. President Truman in his Inaugural Address, January 20, 1949.

NOWHERE in the world was a more fantastic gerrymander devised than the partition of the Indian subcontinent which tore asunder what had been one complete economic unit and left three disrupted areas in its wake—India, West Pakistan and East Pakistan.[1] West Pakistan has 323,000 of Pakistan's total of 377,000 square miles, or five-sixths of the total territory but, of Pakistan's 80 million people, West Pakistan has about two-fifths (some 32.5 million) while East Pakistan, which is only one-sixth the size, has almost sixty percent of the population (some 47 million). East Pakistan is crowded and congested with a population density of 880 per square mile against about 112 per square mile in West Pakistan.[2]

Pakistan, the world's most populous Muslim nation and the seventh largest country from the standpoint of population, came into being in August 1947 as a result of the division of the Indian subcontinent along religious lines. Thus Pakistan celebrated its fifth anniversary last year and it seems appropriate to review the progress which has been made in establishing a viable economy from a very chaotic beginning.

Pakistan is one of the most underdeveloped countries in the world. Partition left it with a food and raw materials (cotton, raw jute, hides and skins, wool) surplus but virtually no industry, while India retained almost all of the industry but incurred a food and raw material deficit because the areas which had customarily supplied surpluses had fallen to Pakistan. West Pakistan produced the raw cotton, India had most of the textile mills. East Pakistan produced the raw jute; India had the jute-processing facilities. The communal rioting and slaughter which accompanied partition and the subsequent devaluation dis-

† The name Pakistan was devised from the Persian "pak" (pure) and "stan" (place) and means "Land of the Pure." Pakistan is a dominion in the Commonwealth of Nations and is currently engaged in formulating its first constitution. It is an Islamic nation. Mohammedanism is the official state religion.

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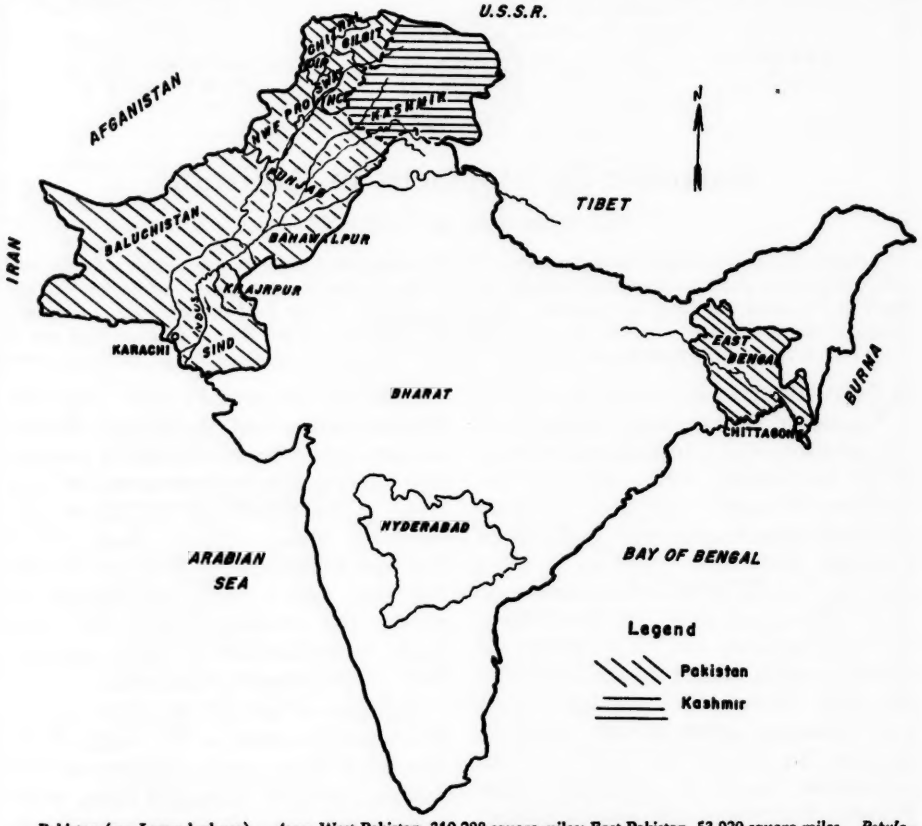
[1] For an excellent account of the political development of Pakistan see Richard Symonds, *The Making of Modern Pakistan* (London: Faber, 1950).

[2] Pakistan Ministry of Economic Affairs, Office of Economic Advisor (Karachi: 1950).

pute further complicated the situation and, for a time, trade between what had once been two complementary areas all but ceased.

Partition cut across the major irrigation system of the subcontinent, leaving in India many of the headworks of canals of fundamental importance to the vast irrigation works in the West Punjab (now a part of Pakistan). Pakistan depended on India for coal, steel, and cotton textiles; India on Pakistan for raw



Pakistan (see Legend above). *Area:* West Pakistan, 310,298 square miles; East Pakistan, 53,920 square miles. *Population:* West Pakistan, 33,568,000; East Pakistan, 42,119,000. Capital City, Karachi (population 1,118,000).

cotton, hides and skins, wool, and raw jute. In communications, as in almost everything else, partition disrupted established lines. The division of Bengal cut squarely across a railroad system designed to bring the raw produce of East Bengal to the marketing, processing and shipping center of Calcutta in West Bengal. Pakistan's initial problems were intensified because most of the important posts in business, government, banking and trade in its area were held by Hindus who fled to India upon partition while the Muslim refugees who streamed into Pakistan were for the most part poor farmers.[3] Thus confronted with weirdly complicated economic problems, Pakis-

[3] For further detail see C. N. Vakil, "The Refugee Problem," chapter II, *Economic Consequences of Divided India* (Bombay: Vora and Co., 1950).

tan had only a handful of trained and technically competent personnel with which to solve them.

Five years after this initial chaos, Pakistan has a vigorous, going economy, to a considerable degree independent of India and among the most stable of the still free countries of Asia, one of the few which registered a net inflow of private investment in 1951. How has this feat been accomplished and what are the prospects for future development?

Pakistan is primarily an agricultural nation; in fact, overwhelmingly so and one of the world's least industrialized countries. More than 85 percent of the population depends on agriculture for livelihood. Only 3 percent of Pakistan's exports are non-agricultural and 70 percent of its imports are manufactured goods. Pakistan's largest industry—textiles—produces only 16 percent of a domestic cloth consumption of only 9 yards per capita per annum. The per capita production of electricity is only 15 percent of that of India and is among the lowest in the world. Installed hydroelectric capacity is only 20,000 KW against a potential of 6,000,000 KW. The extent of Pakistan's lack of industrial development may be seen from Table I.

Agriculture

Because Pakistan is so much an agricultural country the disruption of its economic ties with India attendant upon partition and its failure to devalue its currency along with the rest of the Commonwealth in September 1949 had less of an impact upon the overall economy than might have been the case in a more advanced economic situation. Furthermore, the increase in prices of and international demand for Pakistan's exportable surplus raw materials following the outbreak of the Korean war resulted in a marked improvement in Pakistan's economic position.

Food crops, mainly rice and wheat, account for three-fourths of the total area under principal crops. Rice is the main crop in acreage accounting for 21.5 million of Pakistan's 54 million cultivated acreas.[4] Its production is concentrated in East Pakistan which devotes about 90 percent of its total area to the crop. It is

[4] The 54 million cultivated acres represent about 23 percent of the total area (233 million acres) of the country.

TABLE I—Comparative Levels of Economic Development (a)

Indicator	Unit per 1000 Pop.	Pakistan	India	U.K.	U.S.
Electricity Production	1000KWH	1.9	13	1,033	2,296
Coal Consumption	tons	18	80	3,884	3,473
Petroleum Consumption	tons	11	7.8	327	1,638
Steel Consumption	tons	1.3	3.8	194	364
Cement Consumption	tons	3.6	7.2	148	229
Locomotives	nos.(b)	16	22	410	309
Carrying capacity of railway cars	tons	8.8	10(c)	276	556
Load-carrying road vehicles	nos.	0.17	0.18	16	43
All weather roads	miles	0.1	0.32	3.7	2.2
Telephones	nos.	0.21	0.37	98	261

(a) 1949 figures for India, Pakistan and U.K.; 1948 for U.S.
(b) Per million population.
(c) Excludes 16,516 freight cars for which no carrying capacity is recorded.
Source: The Colombo Plan For Cooperative Economic Development in South and Southeast Asia.

East Pakistan's staple food but production there is not sufficient to meet local requirements and the deficit is normally covered by West Pakistan, whose rice output, though comparatively small, is available for shipment to the East since wheat is its staple food. Wheat is the second most important crop from the standpoint of acreage (10.8 million acres) with over 99 percent of its production concentrated in West Pakistan. Exportable surpluses in some years have been as high as 200,000 tons. Rice production in Pakistan totals about 8 million tons and wheat about 4.1 million tons. Jute and cotton are the principal cash crops, the total acreage of which is small (some 12 percent of that under principal crops) compared to food crops. Cotton is West Pakistan's principal cash crop and is grown mostly in the Punjab, Sind, and Bahawalpur State.[5] Jute, on the other hand, is the most important cash crop of East Pakistan and dominates its economy. Partition left 75 percent or more of the jute-producing area but few baling presses and no mills inside Pakistan. Until Pakistan has operational jute mills presently under construction, it must export its raw jute either to India, which now has less need for it, or to other overseas markets whose processing facilities are limited.

The overwhelming importance of jute and cotton in Pakistan's export trade may be seen from Table II.

The considerable difference in the crops grown reflects the very different climates of East and West Pakistan. In West Pakistan the main problem is to maintain adequate supplies of water, while in East Pakistan flood prevention is the main concern. Most of the productive lands of West Pakistan are irrigated, with double cropping of wheat, rice and cotton, though there is still great need for a considerable extension of irrigation. An extensive system of canal irrigation, particularly in the Punjab, has been developed over the years, since the low rainfall of West Pakistan makes efficient cultivation difficult without irrigation.[6] More than half the irrigated land of undivided India fell to Pakistan and all of it was in the West. In East Pakistan on the other hand, wet cultivation with multiple cropping of jute and rice prevails. There is no need for an artificial irrigation system, for the many rivers with the numerous branches provide natural irrigation. The soil, rich in alluvial deposits, is highly fertile. The average rainfall in East Pakistan is 80 to 85 inches compared to 10.1 inches in the West. The great density of population in East Pakistan results in average holdings of only about two acres and there is considerable rural underemployment. Development problems are thus very different in the two areas.

TABLE II—Composition of Pakistan's Exports
(in millions of Pakistan rupees)

Commodity	1949–1950		1950–1951	
	Value	% of Total	Value	% of Total
Raw Cotton.....	355	43.3	562	33.8
Raw Jute.....	298	36.3	535	32.2
Tea.....	49	6.0	7	0.1
Raw Wool.....	32	3.9	419	25.2
Hides and Skins. .	30	3.7	31	1.9
Others.....	56	6.8	114	6.8
Total.....	820	100.0	1,668	100.0

Source: Government of Pakistan Trade Returns.

Industry, Mining and Power

While Pakistan produces a number of industrial raw materials such as jute, cotton, hides and skins on a substantial scale, it has relatively little industry. At partition, the area which is now Pakistan

[5] See Farhat-Ullah Khan and Ali Arshad, *West Pakistan in Maps and Statistics* (Lahore: 1948) p. 25.

[6] M. Ahmad, *The Economy of Pakistan* (Karachi: Pakistan Institute of International Affairs, 1950), p. 29.

had only 16 comparatively small cotton mills (compared with over 400 much larger ones in India), 9 sugar mills, 5 cement plants, 4 glass works, 3 small tanneries and 7 small match factories. It had no jute, wool, or paper mills and no iron and steel works, though there were a number of small re-rolling mills. Some small machine shops existed but with the exception of the Northwestern Railway Workshops at Moghalpura, none were of any size.

The essential mineral resources necessary for modern industrial power appear to be lacking in Pakistan. There is no iron ore, coking coal, manganese, copper, tin, lead, zinc of any consequence. Pakistan produces some oil, about one million barrels, but this is only one seventh of its annual consumption of some seven million barrels.[7] There are no major coal deposits in Pakistan. Output totaled about 425,000 long tons in 1950 but this was only approximately one-fifth of the total requirements of some two and a half million tons.[8] There are abundant supplies of limestone, clays, gypsum, magnesium and potassium salts, sodium carbonates and sulphates, alum, pyrites, and small deposits of sulphur, which would seem to suggest that Pakistan's best opportunity for industrial development, apart from the processing of its agricultural products, may be the fertilizer, cement and chemical industries. These require a great deal of power and at present Pakistan has little. The rate of consumption of electricity per head is also among the lowest in the world. Of the 40,000 KW generated in Pakistan at the time of partition, only 9,600 KW, despite considerable resources of water power, were supplied by hydroelectric stations (two small installations at Malakand and in Bahawalpur). Some 40,000 KW of capacity, mainly thermal, have been added since partition,[9] but the demand still remains far in excess of the supply and future development of industry is dependent upon a prior or concomitant expansion of power output.

Trade and Finance

Prior to partition the area which is now Pakistan obtained its imports (coal, steel, cotton textiles, etc.) primarily from the remainder of India and from the United Kingdom and sent half its exports (largely raw materials) to these destinations. This was the pattern of trade in years immediately following partition. In 1948, for example, 72 percent of Pakistan's imports came from Commonwealth countries. (India 41 percent, the United Kingdom 25 percent) while 47 percent of her exports went to the same destinations (India 25 percent, the United Kingdom 16 percent). Only 7 percent of Pakistan's imports came from the United States but 14 percent of her exports went to the United States.[10] The period from September 1949 to February 1951, which was marked by Pakistan's unwillingness to devalue its currency and India's equal reluctance to recognize the old value of the Pakistan rupee, resulted in an almost complete disruption of Indo-Pakistan trade and a reorientation of Pakistan's trade away from India, a development which persisted to some degree even after the signing of a trade agreement between the two countries on February 25, 1951 thus ending the deadlock.

Under the terms of this agreement, which ran for 16 months to June 1952,

[7] See W. E. Pratt and O. Good (editors), *World Geography of Petroleum* (Princeton, New Jersey: University Press, 1950.)

[8] M. B. Pithawalla, *An Introduction to Pakistan. Its Resources and Potentialities* (Karachi: 1948) chapter IV, "Geography and Mineral Resources."

[9] Total rated capacity is now about 80,000 KW but total effective capacity is only 50,000 KW.

[10] Foreign Trade Development Council of Pakistan, *The Foreign Trade of Pakistan* (Karachi: Ferozsons, 1950).

Pakistan once again supplied India with raw jute and cotton, foodgrains and hides and skins, while India resumed shipments of coal, cotton yarn and cloth, jute manufacturers, paper, rubber tires, iron and steel and cement. During the year and a half deadlock, however, Pakistan was able to develop additional markets for its jute, cotton and foodgrains, while India made strenuous efforts to grow more jute, cotton and foodgrains. Indian raw jute output doubled between 1948-49 and 1951-52, at a time when Pakistan was also increasing its production. There is thus developing the possiblity of a severe competition between the two countries for world jute markets. If, however, this competition forces jute prices down, it will have a beneficial effect at first at least because jute finds its main market as the lowest priced packaging material and when its price rises it begins to lose ground to paper and cotton, its competitors for this purpose.

The changing orientation of Pakistan's trade is shown in Table III.

TABLE III—PAKISTAN: DISTRIBUTION OF TOTAL VALUE OF TRADE BY COUNTRY

	1948	1949	1950	1951
	(*per cent of total exports*)			
India	25	36	14	35
United Kingdom	16	17	13	13
United States	14	12	7	5
France	4	6	7	10
Hong Kong	3	6	7	1
Japan	1	5	15	5
(*percent of total imports*)				
India	41	30	17	9
United Kingdom	25	26	25	21
United States	7	9	8	6
China	6	4	5	4
Japan	1	7	13	28

Obviously, while Pakistan regained its markets in India as a result of the trade agreement, India failed to resume its old place in Pakistan's import picture. The most significant development has been Japan's emergence as Pakistan's leading supplier, displacing not only India but Britain as well.[11]

Pakistan's balance-of-payments position is dependent to a considerable degree upon the demand for and price of its main export commodities, cotton and jute. Pakistan enjoyed a slight surplus on current account in 1948, a substantial deficit in 1949, a somewhat smaller deficit in 1950, and a very large surplus in 1951, the latter being due largely to the increased price and demand for its cotton and raw jute. On a January 1950 base (= 100) raw jute, by April 1951, reached the spectacular level of 231, raw cotton 156, raw wool 241, and hides 175. Selected import prices, on the other hand, increased only slightly. Thus in 1951 Pakistan enjoyed a very significant improvement in its terms of trade. The improvement in the balance-of-payments position resulted in a rise in external assets from Rs. 856 million in 1950 to Rs. 1,406 million by the end of 1951.[12]

To prevent the inflation in the prices of export goods from spreading throughout the economy the government imposed export taxes on cotton, jute, and wool thereby reducing the ability of the exporters to pay higher domestic prices. Not only was the internal price situation very effectively held in check but, since export and import duties account for two-thirds of the revenues of the government, the improvement in the terms of trade was reflected in a material betterment of Pakistan's fiscal condition. The budgetary deficits of 1948-49 and 1949-50 were followed by substantial surpluses in 1950-51 and 1951-52. Thus the gains

[11] For further discussion of prospects for Japan in Pakistan's trade see Hassan Habib, *Japanese Economic Recovery and Pakistan* (Karachi: Pakistan Institute of International Affairs, 1950).

[12] See *Progress Report on the Colombo Plan by the Consultative Committee* (Karachi: 1952) p. 29. For a detailed analysis of Pakistan's balance-of-payments position see Economic Commission for Asia and Far East, *Economy Survey of Asia and the Far East for 1950* (Bangkok: 1952).

both in Pakistan's balance of payments and in its internal budgetary position were attributable to the improvement in the export markets for its surplus commodities.

More recently, however, the decline in world raw material prices has begun to foreshadow some difficulty for Pakistan. For example, Pakistan's cotton fell from a peak of 65 cents a pound in 1951 to 49 cents during the first half of 1952 and jute declined from a peak of $312 per short ton in 1951 to $199 by mid-1952. Thus the balance of trade, which is shown in Table IV for the past four years, is likely to prove less favorable for 1952 and there may be some consequent deterioration in the internal financial situation.

TABLE IV—Foreign Trade of Pakistan
(In millions of U. S. dollars)

	1948	1949	1950	1951
Exports (f.o.b.)	309	363	668	716
Imports (c.i.f.)	358	428	448	511
Deficit (−)	−49	−65	....	....
Surplus (+)	....	....	+220	+205

Development Problems

Development was a matter of popular discussion and enthusiasm in undivided India and shortly after Pakistan became independent, early in 1948, it established a Development Board under the Minister of Finance and Economic Affairs to coordinate development plans, central and provincial, so that available resources could be put to the best possible use. It was this Development Board which in 1950 prepared the Pakistan section (The Six Year Plan) of the Colombo Plan report and which subsequently worked out a more immediate two-year priority program within the longer six-year plan.

Pakistan's Six Year Plan contemplates total development expenditures of Rs. 2,600 million (approximately $780 million) of which 32 percent is to be devoted to agriculture, 20 percent to transport and communications, 18 percent to fuel and power, 19 percent to industry and mining (excluding coal) and 11 percent to "social capital" (including housing, education, health, water supply, etc.). It was anticipated that by far the greater part of the total expenditure would be incurred by the government, which would be responsible for hydro-electric power, transport, ports, agriculture and irrigation. Of the total expenditure of Rs. 2,600 million it was contemplated that about Rs. 400 million would be provided by private investment in cotton, jute, and paper mills and other industrial enterprises. Thus public investment during the period 1951-57 would require Rs. 2,200 million. Taking into account estimated domestic savings, probable balance of payments deficits including not only development but normal needs of the economy, and sterling releases, Pakistan estimates it will need to obtain Rs. 1,200 million ($360 million) over six years to finance the external costs of the six-year development program.[13] To meet this gap it looks to the International Bank, the Commonwealth and to the United States for both loan and grant assistance. The International Bank has thus far loaned $27.2 million to Pakistan for rehabilitation and modernization of the railways; Commonwealth aid has been forthcoming from Great Britain (sterling releases), Canada ($10,000,000), Australia (£2,000,000) and New Zealand (£250,000). The United States in fiscal year 1951 provided some $500,000 in technical assistance; in fiscal year 1952 about $10.5 million; and in the current fiscal year $14 million.

Aside from problems of public health, education and housing, which in most

[13] For a more extended discussion see Pakistan Ministry of Economic Affairs, *Pakistan Looks Ahead, The Six Year Development Plan* (Karachi: 1951).

Asian countries are so large that they could well absorb all capital available for development, Pakistan development needs can be considered as falling in four major categories.

(*1*) *The Need for Increased Agricultural Productivity.* While Pakistan normally produces a small surplus of foodgrains, the vagaries of the weather in any given year and the increase in population over the next decade may well find Pakistan confronted with a substantial food deficit in the near future. This prospect can be avoided by a combination of measures in the agricultural sector designed to raise yields on existing cultivated land and to put new acreage into use by irrigation and reclamation. Yields in Pakistan while slightly higher than in India are low by Japanese standards, as Table V indicates.[14]

TABLE V—COMPARATIVE FOODGRAIN YIELDS: PAKISTAN, INDIA AND JAPAN
(in 100 kilograms per hectare)

	Rice	Wheat
Pakistan	13.7	8.2
India	11.7	6.6
Japan	37.2	15.8

Source: FAO Yearbook of Food and Agriculture Statistics.

By the use of improved seeds, an extension service, better farm implements, crop rotation and especially application of fertilizer, Pakistan should be able to approach Japanese output levels and thereby not only eliminate the specter of food deficits but ensure substantial surpluses for export. Experiments in the Punjab have indicated that the application of fertilizer alone will raise yields by 30 percent. The gains from increasing agricultural productivity will be limited, however, unless attention is paid to conditions of land tenure and rural indebtedness, problems of considerable magnitude in Pakistan.[15]

There is vast opportunity for an extension of irrigation and reclamation. It is estimated that Pakistan has presently 27 million acres of irrigated land under cultivation, of which 25 million are in West Pakistan, where low rainfall makes efficient cultivation difficult if not impossible without irrigation.[16] Pakistan is irrigated mainly by canals—inundation and perennial—and to some extent by tube wells. Inundation canals draw water direct from the rivers only when the latter are in flood stage. Perennial canals are fed from a barrage system, and permit of continuous irrigation.

The largest and best known irrigation project in Pakistan is the Lloyd Barrage on the Indus, Pakistan's main river, at Sukkur, Sind, completed in January 1932 and which irrigates about 5.5 million acres-more land than is under cultivation in all of Egypt. Other major irrigation projects are the Lower Sind Barrage at Kotri, the Thal Project, and the Rasul tubewell project. The Lower Sind Barrage is presently under construction and when completed by the end of 1953 will irrigate 1.6 million acres presently dependent upon seasonal inundation canals and 1.1 million acres at present uncultivated. It is expected to increase food grain production by about 200,000 tons. The Thal Project is designed to draw water from the Indus and initially irrigate some 700,000 acres in the three Punjab districts, lying between the Indus

[14] For figures on comparative yields of wheat and rice in the periods of 1934 to 1938 and 1945 to 1947 by Leading Country, Japan, World Average, Pakistan and India, see L. Dudley Stamp, *Land for Tomorrow* (Bloomington: Indiana University Press and American Geographical Society, 1952) p. 94.

[15] See "Agrarian Structure and Economic Development," *The Statist*, London, July 28, 1951, pp. 117-118; also "An Ally in Asia: Land Reform," *Fortune*, New York: November 1950, pp. 74-76; and *Land Reform, Defects in Agrarian Structure as Obstacles to Economic Development* (New York: United Nations, 1951) pp. 51-59.

[16] See Walter Godfrey, "Economic and Commercial Conditions in Pakistan in 1950," *Overseas Economic Survey* (London: His Majesty's Printing Office, 1951), p. 69.

river on the West and the Jhelum and Chenab rivers in the east. Scheduled for completion in its initial stage in 1953-54 it is expected to result in increased food grain output of 200,000 tons, sugar-cane of 9,000 tons and cotton of 23,000 bales.[17] The Thal is presently mainly a sandy desert covering almost 5 million acres. A Thal Development Authority modeled on the T.V.A. has been set up because the Government is finding it necessary to do a great deal more than merely build the dam (the Jinnah Barrage) and the irrigation canals. In earlier settlement projects the Government would make bare and unbroken plots of land available to individual settlers who relied on their own resources for the necessary developments. In the case of Thal this technique has been changed because, in the first place, it worked too slowly and, in the second, the type of people (refugees) who are to be settled in this area do not possess the necessary resources. The general conditions in the Thal are also more difficult and forbidding than had previously been faced. As a result, on the initial 100,000 acres already under cultivation the government has built roads and huts or barracks, loaned tractors to break the soil, and given agricultural implements, bullocks, seeds and other necessities of life. Ultimately the project aims to bring 2.5 million acres under cultivation.[18]

Under the Rasul tubewell project in the Punjab some 1,800 tubewells will be installed both to provide irrigation for some 700,000 acres as well as to assist in reclaiming water-logged land by pumping sub-soil water back into the irrigation canals from which it has seeped. As a result of water-logging some 2 million acres have already gone out of cultivation in the Punjab and further land is going out of cultivation at a rate of between 20,000 and 40,000 acres per year. Water-logging in the Punjab has been caused by a rise in the water-table, accompanied by an accumulation of deleterious salts and is due mainly to seepage from unlined canals. By lining the canals and by tubewells it is hoped to prevent further waterlogging.[19]

Altogether irrigation projects approved by Pakistan's Development Board are expected to irrigate some 12.5 million acres to yield about 2.5 million tons of additional crops per annum of which 1.8 million will be foodgrains.[20] If these projects can be carried to completion Pakistan can increase its food exports and expect to find large and stable markets in both India and Japan.

(*2*) *The Need for Increased Electric Power Output.* Pakistan has almost no developed hydro-electric power production but a rich potential. Recognizing this, the government hired a joint British-Swedish engineering firm, Merz Rendel Vattens, to make a power survey of Pakistan. In its 1950 report the firm concluded that Pakistan's lack of power is a major deterrent to further expansion of industrial production.[21] It is estimated that even with limited economic growth the demand for power would by 1955-56 exceed 250,000 KW (compared to present effective steam and hydro-electric capacity of some 50,000 KW). Accordingly, the government, in addition to attempting to provide a number of thermal generating units with total capacity of 140,000 KW in six cities, has pro-

[17] Pakistan Ministry of Economic Affairs, *Pakistan Development Schemes* (Karachi: 1950).

[18] For more detail see "The Thal Project: Lilacs Out of the Dead Land," *Pakistan Affairs*, Vol. V, No. II, January 18, 1952.

[19] R. M. Gorrie, "Countering Dessication in the Punjab," *Geographical Review*, January 1948, pp. 30-40.

[20] This includes a variety of development projects for East Pakistan, the largest of which is the Ganges-Kobadak Development Project which is expected to prepare 2.2 million acres of land for water control, benefiting 3 million people. See *Pakistan Affairs*, May 16, 1952.

[21] See British Mission Report, *Industrial Mission to Pakistan* (London: His Majesty's Stationery Office, 1950).

grammed the following major hydro-electric projects:

TABLE VI—PROJECTED HYDRO-ELECTRIC DEVELOPMENT IN PAKISTAN

Name	Place	Capacity	Estimated Date of Completion
Dargai.....	NWFP	20,000 KW	1953
Malakand.....	NWFP	20,000 KW	1952
Mianwali.....	West Punjab	30,000 KW	1955
Warsak.....	NWFP	90,000 KW	1956
Karnafulli	East Bengal	40,000 KW	1956
Rasul.....	West Punjab	22,000 KW	1952
Total..	.....	222,000 KW	

Source: Government of Pakistan: Six Year Development Plan.

Thus, if by 1956 the Government of Pakistan has successfully carried out both its thermal and hydro-electric development plans, it will have a capacity of more than 350,000 KW, a figure comfortably in excess of its anticipated requirements.

(*3*) *The Need for Improved Transportation and Communication Facilities.* Pakistan inherited a transportation and communication system designed to meet the needs of undivided India, but ill suited for a new nation striving to attain a balanced economy and to lessen dependence upon India. The railway system of West Pakistan (some 5,362 miles) for example, had to face the permanent burden of the non-remunerative military lines of undivided India, most of which lie in the Northwest Frontier Province.[22] The railway system of East Bengal (some 1,620 miles) focused on Calcutta and partition cut the system in half.[23] West Pakistan had only one port, Karachi, with very limited facilities and East Bengal had virtually none until the new Pakistan Government began to develop the port of Chittagong. The nature of the country in East Bengal, extensively broken up by rivers and waterways, makes the transport of goods and passengers by water the principal means of communication. The inland river steamers which formerly carried a large part of the Bengal jute crop to Calcutta were, with one or two exceptions, unable to cross the open water of the Bay of Bengal to Chittagong for most of the year.[24] Before partition the only shipping company with its headquarters in what is now Pakistan was the Karachi Steam Navigation Company, founded in January 1947. This company had only one small vessel. Telecommunications between the two parts of Pakistan, East and West, were non-existent. Western Pakistan has a road mileage of 56,913 of which only 15,883 are usable by motor vehicles and then only in fair weather. Eastern Pakistan has few roads and such as exist are largely submerged in water during the monsoon months. Obviously problems of transportation and communications require major efforts on the part of the government and this has been recognized by the International Bank Loan of $27.2 million in the spring of 1952 for rehabilitation of Pakistan's railway system.

(*4*) *The Need for Industrial Development.* Pakistan is well aware of the need to provide a more balanced economy by increasing the present tiny industrial sector. By measures designed to encourage both domestic and foreign capital investment in the country, by substantial tax concessions, by direct subsidization and by formation of an Industrial Finance Corporation, an Industrial Development Corporation, and a Cottage Industries Directorate, Pakistan is doing what it can within the limits

[22] See K. L. Gauba, *Inside Pakistan* (Delhi: Rajkamal, 1948) chapter 14, "The Pakistan Railway System."

[23] Government of East Pakistan, *East Pakistan, Third Year of Independence* (Dacca: 1950).

[24] See B. B. Ghosh, *Indian Economics and Pakistani Economics* (Calcutta: Mukherjee, 1949).

of its resources to enlarge the industrial sphere.[25]

To encourage private investment in desired industrial development profits up to 5 percent of the capital investment are free of income tax. Special depreciation allowances are given and industrial undertakings commenced or set up in Pakistan after August 14, 1947, have been exempted from the Pakistan business profits tax. Import duties on iron and steel and capital goods have recently been abolished and capital goods have been exempted from the sales tax. Mobilization of capital by tapping small savings through savings certificates and savings stamp drives, has been undertaken by the government. The liberal income from such certificates is tax free. In surprising contrast to the lethargy and traditionalism of the Middle East, everything possible is being done in Pakistan to develop an atmosphere favorable to capital formation, domestic and foreign investment.

The industrial aspects of Pakistan's Six Year Plan are mainly concentrated on processing facilities designed to utilize surplus domestic raw materials. Six jute mills, twenty-four cotton and woolen mills, a paper mill and a number of miscellaneous plants for sugar, ceramics, glass, chemicals, and fertilizer are contemplated. The annual foreign exchange earnings and savings from these industrial facilities will alone equal the original foreign exchange investment required so the economic incentive to carry out the projected plants is very strong.

The Two Year Priority Program, within the Six Year Plan, has an industrial emphasis. In addition to the installation of 140,000 KW of thermal power for immediate industrial use in six cities, it provides for four jute mills of 500 looms each. One has already been completed and two more are likely to begin production in 1953. In cotton textiles, 250,000 new spindles are to be installed, orders having already been placed in Japan. Two cement plants are under construction as well as a large steel rerolling and fabricating mill. A commercial dry dock is being built at Karachi as well as a polytechnic and two trade schools to provide trained technicians for industry.

The targets of the industrial sector of Pakistan's development plan are quite modest for the Government is fully cognizant of the many factors limiting the achievement of these goals. The chief obstacles are lack of fuel and power, availability of managerial talent and skilled technicians and reluctance of domestic capital to invest in industry because the rate of return is not as high as can be obtained in commerce, speculation, land, and money lending.[26] The absence of an entrepreneurial group with experience in handling modern industrial units is a major drawback.

Conclusion

Since obtaining independence in 1947 Pakistan has been beset by difficulties common to new nations. Partition added to these problems, leaving Pakistan with little industrial or power production and an acute shortage of trained administrators and technicians. Pakistan does not possess the essential mineral resources for large-scale industrialization although it does produce small quantities of coal, petroleum, gypsum, limestone and chromite. There is room in the industrial area, however, for a considerable expansion of processing facilities. Partition also

[25] Pakistan Ministry of Economic Affairs, *Investment Opportunities in Pakistan* (Karachi: 1950); also T. A. Kitan, "Problems of Industrialization," *Karachi Commerce*, March 1951, pp. 43-51. See also *Dawn* (Karachi: March 16, 1952) for a discussion of the latest tax concessions for industrial development.

[26] A. F. A. Husain, *Problems of Economic Reform and Development in Pakistan* (Pakistan Institute of International Affairs, 1950).

brought with it the problem of some six million refugees whose care has been a heavy burden on the government. While the standard of living in Pakistan is low ($51 per capita per annum compared to $1,453 in the United States and $773 in the United Kingdom),[27] Pakistan's economy has done remarkably well in the five years since independence. The world-wide increase in demand for and rise in prices of raw materials, following the outbreak of the Korean agression, particularly aided Pakistan since it produces surpluses of several of the commodities which were in demand. The marked improvement in its position in 1950 and 1951 was somewhat precarious, however, since it was largely dependent upon continued high prices for its export commodities and in recent months world-wide demand for these has slackened and prices have fallen off. Consequently, the continued economic development of the country and a better balancing of its economic sectors is essential to longer run stability. The basic and pressing needs are to increase agricultural output and productivity, to develop fuel and power resources, to expand the processing industries, to improve transportation and marketing facilities and to train larger numbers of administrators and skilled technicians. The present government of Pakistan is among the most able, energetic and forward looking in the Middle East. It recognizes that its continued stability is dependent upon economic progress and it should be helped in every possible way to achieve the improvement it so wholeheartedly seeks.

[27] See United Nations, Statistical Papers, *National Income, and Its Distribution in Underdeveloped Countries*, (New York: United Nations Statistical Papers, Series E, No. 3, 1951; Also *Statistics of National Income and Expenditure*, Series H, No. 1, 1952.

Introduction and Utilization of Natural Gas
The Wisconsin Experience

By H. J. O'LEARY*

WISCONSIN was the last state of the midwest to obtain natural gas service. It was not until June 1946 that natural gas was introduced in the state, and then on a limited scale only. In the fall of 1949 and the early part of 1950 natural gas became available in Wisconsin on a much broader basis and gave rise to many problems.

Attempts to bring natural gas to the state had been made much earlier. In 1940 two applicants filed petitions with the Public Service Commission of Wisconsin for certificates of authority to construct natural gas pipelines into Wisconsin. Concurrent applications were filed with the Federal Power Commission. On April 1, 1941 the Federal Power Commission held it had no jurisdiction to entertain the applications under the then existing natural gas act. Subsequently, the Wisconsin Commission determined that it had jurisdiction, and proceeded to hold hearings. In the meantime, a third applicant filed with the Wisconsin Commission for a certificate.

Competition among the applicants to serve the Wisconsin market was very keen, and each applicant sought to outdo the other in demonstrating to the Commission its ability to furnish at the lowest rates all the gas the market would absorb. In addition, the applicants were willing to assume some of the burden of paying for the conversion of customer appliances, and two of the applicants were even willing to contribute money to reimburse distributing companies for production facilities to be abandoned after natural gas became available. The prospective city gate rates offered ranged from about 12 cents per thousand cubic feet to about 20 cents. The producers of gas in the Hugoton field in Kansas and Oklahoma were so anxious to obtain market outlets that they offered to pay some of the costs of conversion and the abandonment of facilities. The 1941 situation is in sharp contrast to that of 1949 when the pipeline to Wisconsin was completed.

After protracted hearings at which the applicants were opposed by coal, railroad and labor interests, the Wisconsin Commission on January 2, 1942 issued a certificate of authority to one of the applicants subject, however, to several conditions. The most important condition was a time limitation for completion of the pipeline.

The date of the order was about one month after Pearl Harbor. Subsequently, on February 7, 1942, the natural gas act was amended by Congress so as to give the Federal Power Commission jurisdiction over extension projects, such as those proposed for Wisconsin. The advent of the war and the necessity for obtaining federal approval led to the abandonment of the projects.

During the ensuing years, Wisconsin became a natural gas battleground. Proponents were led by gas-distributing utilities, and certain agricultural and industrial interests who thought they would benefit from the introduction of natural gas. The opponents were led by railroad, coal and labor interests. The battle was waged principally in the legislature, although considerable pressure

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was also brought to bear on municipal councils.

The initial victory went to the opponents. In April 1943 Chapter 48 of the laws of 1943 became effective. This new law provided that in passing upon applications of utilities to convert to natural gas, the Public Service Commission was required to give consideration to "the social and economic effects thereof by reason of its effect upon employment, existing business and industries, railroad and other transportation agencies and facilities, the state, any of its political subdivisions, or any citizens or residents thereof." In addition the new law provided that no utility could substitute natural gas for manufactured gas in any city, village or town "unless the municipal council thereof shall . . . . approve and authorize the same."

The passage of this law established a standard of public interest entirely different from that contained in the then existing Federal Natural Gas Act. The latter presupposed that the public interest required natural gas service to all markets. Thus consideration was limited to a determination as to which natural gas company should be permitted to render the service. The legislative standard of public interest incorporated in the new Wisconsin Statute, in effect, adopted the standard which had been applied by the Wisconsin Commission in 1942 in the absence of legislative direction. Thus this provision of the new law did not erect any new barriers to the introduction of natural gas except to substitute definition for uncertainty as to the broad meaning of public interest. However, the new provision requiring municipal consents constituted a very real and definite impediment to the introduction of natural gas service. Many of the large industrial areas were very responsive to the desires of the labor, coal and railroad groups in their community.

Several Wisconsin lakeshore cities provide important harbor and dock facilities for the receipt and storage of lake cargo coal. In addition to providing local markets, these cities are important transshipment points for rail delivery of coal to markets west of Lake Michigan. Thus, coal, railroads and labor all had a substantial interest in the coal business in the lakeshore cities. The refusal of any of these cities, or of other municipalities lying in the path of a proposed natural gas transmission line, to grant permits or to accept natural gas service could seriously impair both the economic and physical feasibility of a proposed natural gas pipeline.

However, the Wisconsin Legislature saved its best punch until later. In June 1943 it passed a law providing for an excise tax of 7 cents for each one thousand cubic feet or fraction thereof to be levied on the use or consumption of natural gas in the state. The amount of this tax ranged from 70 percent to 30 percent of the level of city gate rates which had been proposed in 1941. In fact, the excise tax might in some cases equal 50 percent of the retail rate for certain uses. The economic strangulation of such a tax effectively stopped all further consideration of proposals to extend natural gas service into Wisconsin on a broad-scale basis. By that tax Wisconsin declared to the nation at large that it was an enemy of natural gas service.

This unfavorable political climate prevailed until March 1947 when the legislature removed the principal deterrent by repealing the 7 cent excise tax. However, during the four years the tax was in effect, an economic revolution was taking place in the major gas-producing areas in southwestern United States.

Prior to world war II a buyers market for natural gas was prevalent. Gas could be purchased at the wellhead for from 2 to 4 cents a thousand cubic feet. Many producers could find no market for their gas and competition for available markets was keen. Transcontinental pipe lines were few in number. Many lease holders and royalty owners had no market outlets and were unprotected from subsurface drainage by producers who had market outlets. At the market end, the relationship between the price of gas and competing fuels, coal and oil did not stimulate gas consumption for either industrial or heating purposes. Millions of cubic feet of gas were flared daily in the producing fields because market prices did not warrant the expense of collecting dry gas in isolated places or the gathering and processing of casinghead gas for pipeline delivery.

World War II brought about a sudden termination of the buyers market. Competitive price relationships shifted rapidly in favor of gas as a fuel. A rapidly growing giant of the petro-chemical industry was born. Existing pipelines were expanded and new pipelines extended to new markets as fast as steel could be obtained. Intense competition developed to secure new and additional gas reserves. The gas reserves in flush producing areas represented by the two largest fields, Hugoton and Panhandle, were committed to pipelines and other users. Additional reserves of gas had to be obtained from smaller and more distant fields.

Prices at the wellhead began to increase. With each increase it became economically feasible to collect more and more casinghead gas from oil wells and widely scattered dry gas wells, and to process gas with a high sulfur content for pipeline delivery. In the meanwhile, the producing states had been active in adopting measures designed to protect owners of gas from subsurface drainage by allocating market demands and requiring ratable taking of gas. During the same period the cost of extending gas transmission lines increased rapidly. The cost of steel plate, a major item, increased threefold from 1940 to 1950. With corresponding increases in other material costs and labor, the capital required to build a pipeline in 1950 was from two to three times the amount required in 1940.

The penalty subsequently paid in Wisconsin for the delay of about 7 years in obtaining natural gas is not capable of precise mathematical measurement. Two things are sure. The delay cost Wisconsin distributing utilities at least 30 to 50 percent more for gas at the city gate, and it deprived those utilities of a plentiful supply of gas with which to fully develop their markets. The consequences are now being perpetuated in rates to ultimate consumers which are much higher than they otherwise would have been and considerably higher than the rates charged in surrounding communities which obtained natural gas before World War II.

Although the delay inflicted penalties on Wisconsin, the arrival of that gas did produce certain benefits. These can be evaluated by an examination of the condition of the manufactured gas industry for several years prior to the advent of natural gas.

For many years, sales of manufactured gas had been almost static. In fact, sales to residential customers had been declining, principally due to the inroads of competition from electric service. While rates for manufactured gas service had remained practically unchanged, substantial reductions in electric rates were being made almost continuously. Many of these reductions were of the promo-

tional type, specifically designed to encourage and develop electric cooking and water heating. Improvements in electric ranges and water heaters accelerated the competition with gas service.

In 1932 the average revenue per Mcf for residential gas service was $1.08, the average annual consumption was 31.3 Mcf, and the average annual bill was $33.60. In 1949 the average revenue per Mcf was $1.30, the average annual consumption was 31.5 Mcf, and the average annual bill was $40.70. Since consumption remained nearly static, the higher revenue per Mcf and the higher annual bill in 1949 as compared with 1932 was attributable to rate increases. After 1932 the revenue per Mcf declined gradually to a low point of $1.01 in 1946. Likewise, the average annual consumption declined to a low point of 26.1 Mcf in 1941 and 1942. The average annual bill declined steadily to a low point of $26.80 in 1942. The war stimulated some increase in consumption but also brought about increased rates for service. It is significant that average usage per customer did not even recover to the 1932 level until 1948.

By way of contrast, for residential electric service in Wisconsin, the average revenue per kilowatt-hour decreased from 5.32 cents in 1932 to 2.67 cents in 1949, the average annual usage increased from 587 kilowatt-hours in 1932 to 1.917 in 1949, and the average annual revenue per customer increased from $31.30 in 1932 to $51.10 in 1949. The evidence is clear that in Wisconsin electric service expanded and became cheaper at the expense of manufactured gas.

The market for space heating by means of manufactured gas remained relatively untouched prior to the introduction of natural gas. With a declining use of gas for general and industrial purposes some utilities attempted a promotional development of gas space heating. However, rates were not competitive with either coal or oil, so that development was, for the most part, limited to customers who were willing to pay a substantial premium for the advantages of gas heating. However, in the several years just prior to the introduction of natural gas the competitive situation was reversed. The price of heating oil increased from about 7 cents a gallon to 14 cents, and the price of coal over a longer period increased about proportionately. Furthermore, at certain times, both coal and oil were in short supply. As a result a new demand for gas space heating developed and some of the companies did not have sufficient capacity to serve the requested loads. The Commission then found it necessary to issue orders restricting the connection of space heating loads.

The trend of rates for manufactured gas service was upward in the years prior to 1950. Costs of coal and oil used in the manufacture of gas increased substantially following the war. The gas companies also experienced substantial increases in labor costs and prices of materials. In 1949 production costs per therm for each of the 8 distributing companies which converted to natural gas in 1950 ranged from 6.05 cents to 23.8 cents.

Company	*Production cost per therm*
Milwaukee Gas Light Company.....	6.05c
Wisconsin Natural Gas Company....	8.92c
Madison Gas & Electric Company...	11.56c
Wisconsin Public Service Corporation.	10.68c
Wisconsin Power & Light Company..	10.05c
Wisconsin Michigan Power Company.	14.32c
Wisconsin Fuel & Light Company...	8.87c
Stoughton Light & Fuel Company...	23.80c

Although the post war period brought about a revival of demand for gas for industrial purposes and an additional demand for space heating, sales did not keep pace with increases in expenses.

Several companies were granted rate increases and in some cases it was necessary to increase rates more than once. Despite these increases in rates the earnings of the manufactured gas utilities were not adequate. The competitive situation was such that earnings could not be raised to a reasonable level by increasing rates. For most companies the trend of earnings would have created difficulty in raising capital for continued manufactured gas operations.

In view of the difficulty in raising capital and the imminence of natural gas service several distributing utilities had permitted their production facilities to deteriorate. Generally, utilities operating coal gas production facilities did not attempt to maintain equipment at full efficiency in the years immediately preceding the introduction of natural gas. It was considered that such facilities would not be used subsequently for standby service. On the other hand, water gas production facilities were fully maintained and liquefied petroleum gas facilities were not only maintained but expanded. Both types of equipment were considered to be useful for standby after the introduction of natural gas.

The combination of reduced production facilities and increased demands in certain instances resulted in some impairment of service. Pressure difficulties were encountered and in some cases it was necessary to increase the heating value of the gas in order to meet minimum service demands. The standard heating value for manufactured gas in Wisconsin was 520 btu per cubic foot.

The situation in 1949 just before the introduction of natural gas showed: (1) A political atmosphere in Wisconsin which was not entirely free from hostility toward the introduction of natural gas. (2) The establishment of a sellers market in the natural gas-producing areas in Southwestern United States. (3) Severe inflation in the cost of building gas pipelines from the source of supply to the market. (4) A relatively static situation with respect to domestic and commercial sales of manufactured gas in Wisconsin. (5) A growing demand for gas for industrial and space heating purposes. (6) Some deterioration in the quality of service furnished. (7) A rising trend in rates for manufactured gas service. (8) Inadequate earnings for manufactured gas operations.

The pipeline which now serves most of the Wisconsin market is owned and operated by Michigan-Wisconsin Pipeline Company, This company is a wholly-owned subsidiary of American Natural Gas Company. The two largest customers of the Pipe Line Company are Michigan Consolidated Gas Company serving Detroit and other areas in Michigan and Milwaukee Gas Light Company serving Milwaukee and surrounding areas in Wisconsin. Both companies are subsidiaries of American Natural Gas Company and collectively account for 77 percent of the total annual sales of the Pipe Line Company.

One of the significant features of the pipe line is that at its Michigan terminus there is a large underground storage installation. The working capacity of the storage fields is about 37 billion cubic feet. The daily capacity of the pipeline is now 303 million cubic feet and, operated at 100-percent-load factor, the annual capacity is 110.595 billion cubic feet. The Pipe Line purchases all of its gas from Phillips Petroleum Company in the Hugoton field in the Panhandle area of Texas and Oklahoma.

The storage feature permits operation at 100-percent-load factor throughout the year, yet at the same time permits a much higher saturation of low load factor space heating than could be served

from a line of equal daily capacity without storage. For all practical purposes there is no interruptible gas available from the pipe line. During periods of mild weather when space heating demands are reduced, the excess gas is injected into storage. During periods of severe weather gas is withdrawn from storage to supplement the capacity of the pipe line. The character and design of the pipe line has of necessity influenced the nature of the loads developed by the distributing companies.

The load developed by the distributing companies has also been affected by the form of the city gate rate. Most pipe lines apply a demand and commodity rate. Such a rate form induces load factor improvement, since the cost of gas can be reduced by improving load factor. However, because of its storage operations, Michigan-Wisconsin Pipe-Line Company has been able to maintain a load factor of approximately 100 percent at all times. Hence, it has adopted a commodity-type city gate rate. The initial rate was 30 cents per thousand cubic feet. Subsequently this was reduced to 28 cents. In recent months, the Pipe Line Company has been charging a rate of 31.5 cents under bond, and since December 12, 1952 the rate has been 35 cents, also under bond.

The territory served by Michigan-Wisconsin Pipe Line Company in Wisconsin embraces the industrial lakeshore area from Green Bay south to the state line and extends west to a line drawn from Beloit on the south state line to Appleton, approximately 150 miles northeast. This area contains a population of about 2,100,000 or 61 percent of the state total. It includes 15 of the 19 cities in Wisconsin having a population in excess of 20,000.

The principal immediate problem created by the introduction of natural gas was the conversion of customer appliances. Most of the utilities had been furnishing gas with a heating value of about 520 btu per cubic foot. The heating value of the proposed natural gas was about 970 btu per cubic foot. Individual consumer appliances had to be adjusted so that they might efficiently utilize natural gas with a higher heat content. The conversion job was large and expensive. Inflation again took its toll. Only a few years before the average cost of making such conversions was about $8.00 for a customer. The actual cost experienced by the Wisconsin utilities in 1949 and 1950 averaged in excess of $16.00. Unlike 1941, there was no proposal on the part of the Pipe Line Company to share such costs.

In all cases the initial financial burden of paying for conversion of customer appliances was met by the distributing utilities. Arrangements were made with the Wisconsin Commission to amortize these costs over a 5- or 10-year period as seemed appropriate under the circumstances. The allowance of annual amortization in operating expenses transferred this cost to the consumers, although tax savings reduced the ultimate cost.

A second serious problem faced by most of the distributing utilities was the necessity of rehabilitating transmission and distributing facilities and meters and services. The market for manufactured gas had been stagnant and undeveloped for many years. Many facilities were inadequate to meet the demands of increased loads. The substitution of "dry" natural gas for "wet" manufactured gas created leak and dirt problems in the distribution system, and also affected meter accuracies. Most of the utilities found it necessary to introduce extensive programs to eliminate leaks and to seal their systems against future leaks. Many services and mains had to be cleaned, and

others replaced. New pressure regulators were installed and existing ones adjusted. Many meters required replacement or repair to meet accuracy standards. These items of expense were large for most companies. In fact, one company sought and obtained permission to amortize these extraordinary expenditures over a 10-year period.

One of the most perplexing problems arising from the advent of natural gas was the necessity for and extent of local standby facilities. Experiences elsewhere did not seem to provide any satisfactory quantitative standard. A review of practices followed in other jurisdictions disclosed a policy that useable production capacity should be retained irrespective of the relationship of that capacity to existing or prospective service requirements. The location of a large storage field at the Michigan Terminus of the Pipe Line reduced the risk of service interruptions due to pipe line failure. For the most part, the program adopted by the Wisconsin Commission was one of extreme caution. Almost any facility which was capable or could be made capable of producing a satisfactory substitute gas was allowed to be continued in service. The consumer bears these costs by way of fixed charges on seldom-used facilities plus the costs of test runs and maintenance and in some cases additional costs of maintaining standby operating crews. Whether the insurance of continuity is worth the price that is being paid is a question. However, municipal authorities as well as the utilities and the Commission have been reluctant to gamble with possible service interruptions, at least in the first years of natural gas service.

The principal immediate benefit of natural gas service was the large savings in the cost of gas. The initial Pipe Line rate of 2.89 cents per therm compares with manufactured production costs ranging from 6.05 cents to 23.8 cents per therm. Upon the introduction of natural gas, each of the 8 distributing utilities made substantial rate reductions. The reductions totaled about $5,400,000 and were in the order of 25 percent. However, other claimants appeared upon the scene as soon as it became apparent that the distributing companies had a chance of improving their financial situation. After years of short rations, new labor contracts were negotiated and new or improved pension plans for employees were installed. Despite this there have been some additional rate reductions since natural gas became available. However, at the present time (January 1953), the 2 largest distributing companies have rate increase applications pending before the Wisconsin Commission.

For the immediate future it appears that, on the average, retail rates for natural gas service, particularly for residential and general commercial service, will be little if any lower than the immediate post war rates for manufactured gas service. However, rates will be considerably lower than if manufactured gas operations had been continued. For the immediate future at least, the cost of natural gas service is being held at a high level by:

1. Continuously increasing city gate rates charged by the Pipe Line Company.
2. Annual amortization charges to cover costs of conversion of customer appliances.
3. Heavy initial costs of rehabilitating distribution systems, services and meters.
4. Cost of maintaining standby production facilities.
5. Increased labor and other costs incident to the change from an austerity regime to one of more abundance.
6. Increased taxes.

There is now available a limited amount of data from the experience of

the Wisconsin distributing utilities under natural gas service. The Wisconsin Commission made special studies of three of the largest distributors, comparing 1949 manufactured gas operations with 1951, the second year of natural gas operations for each of the three companies. Some of the more significant changes are shown in the attached appendix.

These studies show increases in sales of gas averaging around 100 percent. The increase in sales is due primarily to major increases in spaceheating and industrial loads. Sales of spaceheating gas increased from 200 to 700 percent. Two of the three companies increased industrial sales by more than 100 percent. Despite rate reductions of from 20 to 27 percent, revenue increases ranged from 17 to 56 percent. Production expenses per therm were reduced from 47 to 72 percent. The principal changes in other costs per customer showed considerable variation. One company experienced a reduction of .8 percent in transmission and distribution costs while the other two companies had increases of 46 percent and 75 percent. Increases in customer accounting and collecting expense averaged about 20 percent. Increases in sales promotion expense ranged from 48 to 197 percent. The range of increases for general and administrative expenses was from 12 percent to 114 percent. Depreciation expenses increased with increases in plant. Taxes increased from 123 percent to 253 percent. In all cases the increase in income taxes was 200 percent or more. The substantial increase in income taxes resulted not only from additional taxable revenues but also from a sharp increase in federal income tax rates.

Reductions in the cost of gas were largely offset by increases in other categories of expense. The increase in taxes was especially severe. As a result, improvements in net operating income and net return were quite moderate.

A review of these three analyses shows that despite substantial rate reductions revenues have increased materially. The factor principally responsible for increased sales and revenues is the rapid development of space heating. Prior to natural gas the distributing utilities could not afford to offer space heating service at rates which were competitive with other fuels. Furthermore, several companies lacked sufficient capacity to meet space heating demands even if rates had been satisfactory. Increases in industrial load reflect restoration of competitive pricing with natural gas service available.

The trend of sales and revenues for these three companies points up a current transition of considerable significance. Under manufactured gas service, the principal sources of revenues were residential and commercial service. These sales and revenues were quite stable, the customer demands being relatively inelastic. Pricewise, competition was not too severe, although service and convenience were competitive factors. It is apparent that under natural gas the distributing companies will become primarily purveyors of fuel for heating and industrial applications. For most industrial applications, competition among fuels is sharp and price is almost the sole basis of choice. Gas for space heating must compete with coal and oil both on price and convenience bases. Because of its convenience and cleanliness gas can probably command a premium price but it can never get too far out of line with costs of alternative fuels. It seems that, in the future, the rate level applicable to residential and commercial customers will depend largely upon the ability of the utility to sell space heating and industrial gas at a profit. This is a

reversal of the situation which prevailed before natural gas.

In Wisconsin, 1953 will witness the termination of the development period. This period comes to a premature end not because of any diminution in the demand for service but because of lack of supply from the Pipe Line Company. Thus the distributing companies will be deprived of a normal development period, and the inevitable result will be the continuance of higher retail rates than would otherwise prevail.

A heavy burden of costs must be assumed by a distributing company in the early years of natural gas service. Rapid load development would help overcome these initial extraordinary costs. Such development can take place only if there is an adequate supply of gas. Most of the Wisconsin companies will have their development halted with a space heating customer saturation of only from 23 to 25 percent and with a very low industrial load development. This space heating saturation compares with an average for the industry of approximately 65 percent.

It is well known that costs of gas distribution do not increase proportionately with increased sales. The major portion of the distributing companies' investment when natural gas is purchased is represented by mains, services and meters.. The proportion of total costs represented by variable costs decreases considerably with the change from production of manufactured gas to the purchase of natural gas. Thus unit costs can be decreased sharply by increased sales. Such cost reductions would not only help to offset constantly increasing rates from the Pipe Line Company but also would contribute to further rate reductions. While present rates are lower than they would be with manufactured gas service, by almost any standard of comparison they are high for natural gas service. With an adequate supply of gas, the prospect for increasing sales and decreasing rates would be very good.

The Wisconsin experience with natural gas is unique in that the two largest of the Pipe Line company's 16 customers are affiliated, and the largest customer is a partial requirements customer whose base load is furnished by another non-affiliated pipeline. The Wisconsin Commission has had to spend considerable time and effort both at home and before the Federal Power Commission in Washington trying to overcome or prevent what it considered to be favoritism in rates and supply. Considerable time and money would be saved if the Pipe Line Company and all of its customers were dealing at arms length with each other.

In conclusion, while Wisconsin distributing companies and their customers have derived great benefits from the introduction of natural gas the situation of the the industry will remain relatively static unless the supply road block can be removed. In reaching this conclusion, it is difficult to avoid comparing the present situation with what might have been if gas had been introduced as proposed in 1941. That conjecture can be epitomized by an expression made famous in World War II, "Too little and too late."

APPENDIX

Milwaukee Gas Light Company, by far the largest distributing company in Wisconsin, completed the changeover by January 1, 1950. In the latter part of December 1949, it reduced its retail rates by about 20 percent. A comparison of 1949 manufactured gas operations and 1951 natural gas operations shows:

(1) An increase of 114 percent in sales of gas including an increase of 403 percent in space heating sales and a 205 increase in

industrial sales. Residential and commercial sales increased about 10 percent.
(2) Despite a substantial rate reduction revenues increased about 56 percent.
(3) Production costs per therm were reduced by 47 percent.
(4) Costs per customer were as follows:
   a. Transmission and distribution costs decreased 8 percent.
   b. Customers' accounting and collecting costs increased 23 percent.
   c. Sales promotion costs increased 197 percent.
   d. Administrative and general expenses increased 114 percent, due principally to adoption of a new pension plan and a substantial increase in payments for special services.
(5) Total plant increased by 43 percent.
(6) Annual depreciation charges increased 14 percent.
(7) Total taxes increased 123 percent including an increase of 243 percent in income taxes.
(8) Expenses were further increased by the addition of annual amortization charges covering conversion of customer appliances and extraordinary maintenance.
(9) The rate of return increased 6 percent.

Madison Gas and Electric Company completed its conversion about January 1, 1950 and reduced rates about 27 percent during the first year of natural gas service. A comparison of 1949 and 1951 shows:

(1) An increase of 84 percent in gas sales including an increase of 200 percent in space heating sales. Residential and commercial sales increased 12 percent.
(2) Revenues increased 17 percent.
(3) Production expense per therm was reduced 72 percent.
(4) The changes in various other costs per customer were:
   a. An increase of 46 percent in transmission and distribution expense.
   b. An increase in customers' accounting and collecting expense of 21 percent.
   c. An increase in sales promotion expense of 49 percent.
   d. An increase of 12 percent in general and administrative expenses.
(5) Depreciation expense increased 30 percent.
(6) Taxes increased 253 percent principally because of an increase of 334 percent in income taxes.
(7) Net operating income increased by 77 percent.
(8) The rate of return increased 47 percent, thereby prompting the Commission to order further rate reductions.

Wisconsin Natural Gas Company, the second largest distributing company, completed conversion about February 1, 1950. Both before and soon after conversion retail rates were reduced a total of about 26 percent. A comparison of 1949 and 1951 shows:

(1) An increase in gas sales of 127 percent including a 718 percent increase in space heating sales and a 131 percent increase in industrial sales. Residential and commercial service increased about 9 percent.
(2) Revenues increased 30 percent.
(3) Production expense per therm was reduced 65 percent.
(4) The changes in other costs per customer were:
   a. Transmission and distribution expenses increased 75 percent.
   b. Customers' accounting and collecting expense increased 17 percent.
   c. Sales promotion expense increased 109 percent.
   d. Administrative and general expenses increased 27 percent.
(5) Depreciation expense decreased 17 percent due primarily to abandonment of coke oven production facilities.
(6) Taxes increased 131 percent including an increase of 198 percent in income taxes.
(7) Rate of return increased 55 percent.

Administration of Grazing Districts

By J. RUSSELL PENNY *and* MARION CLAWSON*

THE grazing district is the largest type of land administration unit in the United States. More than 160 million acres, including federal and private lands administered under agreement, are covered by grazing districts.[1] These lands make up an integral part of the total resources and economy of the ten western states. In spite of the national importance of grazing districts, little has been written of their formation, organization, and functions. A brief historical summary will help to bring the subject into proper focus.

History of Grazing Districts

Grazing by domestic livestock on the western range lands, other than the Spanish settlements, began with the famous Texas trail herds that brought hundreds of thousands of cattle into the Great Plains area between 1865 and 1890. Around 1870 the large cattle ranches were established. By 1890 most of the open range was in full use by domestic livestock. The coming of the railroads in the early 1880's brought an influx of settlers that continued until the first World War. The open range was homesteaded rapidly and cattlemen were crowded to the point of resisting encroachment by force. With the homesteader came fencing and the wide open spaces were gone forever.

The cattlemen sought to control the range by acquiring the limited areas of meadow land and the better watering places. Competition was intensified with the coming of the sheepman who also acquired strategic footholds by "corraling" the water, and in some areas by acquiring portions of railroad land grants made up of alternate sections of land. The notorious sheep and cattle wars resulted.

Control of the range by ownership or control of strategic lands was successful only to a relatively minor degree. The philosophy became "first come, first served." This cut-throat competitive type of grazing had a decidedly detrimental effect on the forage and land. Forage plants, under extreme heavy use, became weakened and the better plants, destroyed. In some areas vegetation became so sparse that serious erosion problems arose. Many of the stockmen knew the folly of this system of grazing but were helpless to correct it.

The need for control was recognized early. The Public Land Commission in 1880 suggested that land valuable chiefly for grazing be disposed of in blocks large enough to support ranches of 2,560 acres. In 1905 the Commission suggested the creation of federal grazing districts. When this failed, many important range areas were set up as national forests, the primary administrative function of which was to control grazing. In an attempt to place grazing lands under private ownership, several special homestead acts were passed between 1904 and 1916 bringing approximately 100 million acres under private ownership.

Stockmen were much divided as to whether there should be state or federal control or whether the public domain should go into private ownership. Some even wanted the status quo. They were generally unified in one basic respect; that was to obtain stability in the live-

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[1] *Report of the Director of the Bureau of Land Management, Statistical Appendix* (Washington: U. S. Department of the Interior 1951), Tables 4, 10, pp. 6, 12.

stock industry. They wanted forage to be protected from trespass. By the late 1920's agitation for federal control became stronger and many bills were introduced through the early 1930's. A special Act of Congress in 1928 provided for the creation of the cooperative Mizpah-Pumpkin Creek Grazing District in Montana. Rivalry sprang up between the Department of the Interior and the Department of Agriculture as to which should have jurisdiction over the public lands. The question was settled June 28, 1934, by passage of the Taylor Grazing Act, providing for administrative control of the public domain under the Department of the Interior and the creation of grazing districts.[2]

Taylor Act Opens New Era

To quote the President's statement on approval of the Taylor Grazing Act:

"It confers broad powers on the Secretary of the Interior to do all things necessary for the preservation of these ranges, including, amongst other powers, the right to specify from time to time the number of livestock which may graze within such districts and the seasons when they shall be permitted to do so. The authority to exercise these powers is carefully safeguarded against impairment by state or local action. Creation of a grazing district by the Secretary of the Interior and promulgation of rules and regulations respecting it will supersede State regulations of grazing on that part of the public domain included within such districts."[3]

For the first time in American land history, comprehensive and general authority was given for classification of land according to its highest and best use and for rejection of applications for other uses. Homesteading was still allowed for entries up to 320 acres of land considered most valuable or suitable for agricultural crops. Authority to make land exchanges with states and private individuals was provided, the primary purpose being to consolidate federal lands into more compact blocks. The Act also provided for transfer of lands from grazing districts to national forests, and vice versa, when more effective administrative boundaries would result and for sale of isolated or disconnected tracts up to 1,520 acres and un-isolated tracts, mountainous or too rough for cultivation, up to 760 acres. Conservation and propagation of wildlife with the right to hunt and fish legally within the grazing districts was preserved. Provisions were made also for programs on erosion and flood control, water development, and general improvement of the lands. The Taylor Grazing Act was in fact a multiple-use act.[4]

Regarding grazing, the Act provided for the establishment of grazing districts and for issuance of leases in areas not suitable for district administration. This article is concerned chiefly with the administration of the federal range within districts where permits can be granted for periods up to a maximum of 10 years.[5]

Provision was made for local hearings on appeals from the decisions of the administrative officer in charge of grazing districts. The charging of reasonable grazing fees was authorized. Fifty percent of such fees were to be returned to the state in which they were earned, to be used as prescribed by the state legislature; 25 percent of the fees were to be used for range improvement purposes, and 25 percent were to remain in the United States Treasury. This distribution of fees was changed somewhat in 1947, when separate grazing fees and

[2] Marion Clawson, *Uncle Sam's Acres* (New York: Dodd Mead & Co., 1951), pp. 111-117.

[3] Taylor Grazing Act Statement of the President on Approval of the Act (Washington: Government Printing Office, 1934), preface.

[4] J. A. Krug and Marion Clawson, *The Federal Range Code for Grazing Districts, Revised to October 1, 1949.* (Washington: USDI, Bureau of Land Management, 1949), pp. 8, 9.

[5] Reference for regulations regarding grazing leases: *Title 43, Code of Federal Regulations* (Washington: Government Printing Office, 1949), Part 160, pp. 240-245.

range improvement fees were provided with 12½ percent of the grazing fees to be returned to the states, and 87½ percent to remain in the United States Treasury. All of the range improvement fee is made available by appropriation for construction and maintenance of range improvements.[6]

To provide for placing the remaining public lands into their best use and prevent a rush of land settlement entries before provisions of the Act could be made effective, all lands were withdrawn from entry (Executive Orders 6910, November 26, 1934, and 6964, February 5, 1935). Amendments to the general orders were made from May 1935 through May 1936, permitting, among other uses, entries for land sales, land exchanges, and leasing for grazing use of lands outside of grazing districts.[7]

General meetings were held throughout the west by representatives of the Department of the Interior to explain the provisions of the Taylor Grazing Act to the stockmen. Shortly thereafter, as provided by the Act, and before grazing districts were formed, a public hearing was announced in the state to consider establishment of grazing districts. Publication of such notice had the effect of withdrawing all public lands within the exterior boundaries of such proposed grazing districts from all forms of entry or settlement.

Farrington R. Carpenter was appointed by the Secretary of the Interior to administer the law. A separate division in the Office of the Secretary, the Division of Grazing Control (later to become the Grazing Service and then the Division of Range Management in the Bureau of Land Management), was formed. The new organization was originally staffed with 17 men drawn from the Geological Survey, General Land Office and Forest Service. In January 1936 the organization was expanded through selection of persons from civil service rolls. An early fear among the livestock men that the organization might be composed of men lacking practical understanding of the range industry was offset by an amendment to the Act, in 1936, requiring that prior to appointment, the administrative personnel must have at least one year's residence in the state or states in which they were to serve and that consideration be given to practical range experience.[8]

State-wide hearings were held and committees were designated by the stockmen to recommend areas in that state which should be included within grazing districts and where the district boundaries should be. The areas recommended by these state committees, far exceeding the original 80-million-acre limitation, indicated the strong sentiment in favor of grazing control and led to the increase to 142 million acres by amendment to the Taylor Grazing Act in 1936. What districts should be established under the limitation was then determined, followed by the preparation and issuance of Executive Orders establishing 37 grazing districts.[9]

Advisory Boards: A "Grass Roots Council"

Immediately after the grazing districts were formed, one of the most significant aspects of the administration was put into effect—the election of advisory boards. The Department, recognizing the advantage of local knowledge and experience, had proposed advisory boards elected by the stockmen themselves. These boards proved to be such an asset to the functioning of grazing districts

[6] J. A. Krug and Marion Clawson, *The Taylor Grazing Act of June 28, 1934 with Amendments to October 1, 1949* (Washington: USDI, Bureau of Land Management, 1949), Section 10, p. 7.

[7] *Title 43, Code of Federal Regulations* (Washington: Government Printing Office, 1949), Sec. 297.11-18, pp. 660-662.

[8] The Taylor Grazing Act, *op. cit.*, Sec. 17, p. 10.

[9] *Title 43, Code of Federal Regulations* (Washington: Government Printing Office, 1940), Sec. 502.1, pp. 19-22.

that the Act was amended in 1939, giving advisory boards legal recognition and permanent status. The Act specifically provided that advisory boards include five to twelve members to be elected by the stockmen with an additional member to be appointed by the Secretary of the Interior to represent wildlife interests in the district. These boards were granted advisory powers only and could be, and sometimes were, and are overruled by administrative officials.[10]

Advisory board members in 1940 were organized into a National Advisory Board Council to consider and make recommendations on grazing administration and problems of a national scope. Shortly thereafter state advisory boards were formed in several of the states. An amendment to the Federal Range Code for Grazing Districts in 1949 officially provided for state advisory boards and the National Advisory Board Council.[11]

Development of a Range Code

The consideration of applications for grazing privileges was the first act of grazing district administration. Throughout all districts the demand generally far exceeded the forage supply. To apportion the available range so that each user would get his proportionate share of forage and could use it in keeping with principles of good range management was a primary goal. Temporary rules were replaced in 1938, with the Federal Range Code approved by the Secretary of the Interior, which set forth in detail regulations governing the administration.

Possession of sufficient privately-owned or controlled base property, land or water, to insure a year-round operation for the permitted livestock, was required of all users. In areas where private land is the backbone of ranching operations, land was considered as the base property. In such areas the permitted livestock was required to spend a specified amount of time on the private land being offered as a basis for securing grazing privileges. However, in the arid southwestern United States water is considered the principal basis for receiving grazing privileges. Applicants there were required to have privately-owned or controlled water suitable for consumption by livestock and available, accessible, and adequate during those months for which the range was classified as suitable for use.

Preference for grazing privileges was given operators who made substantial grazing use of the public lands in connection with their private properties for two consecutive years or any three years in the five years preceding the Taylor Grazing Act (known as the "priority period," June 28, 1929 to June 28, 1934). For districts established or for additions to districts after June 28, 1938, the priority period for land base property is the five years immediately preceding the date of the order establishing them. This provision was extended to water base property on March 16, 1942. Thus grazing privileges were attached to the land rather than to the individual or the livestock.[12] By later amendment provision was made for the transfer of grazing privileges from one property to another.

The amount of available forage to be apportioned was at first estimated very largely upon the knowledge and advice of advisory boards. These estimates, although often too liberal, in a surprising number of cases were in accord with detailed range surveys and studies made later. They were altered or supported according to those findings.

[10] *The Federal Range Code——, op. cit.*, Sec. 161.12 (a)-(i), pp. 27-31.

[11] *Ibid.*, Sec. 161.12 (J)-(L), p. 31.

[12] *The Federal Range Code, Approved; August 31, 1938, With Amendments Approved, September 18, 1939, December 5, 1940, February 26, 1941* (Washington: USDI, Grazing Service, 1941), Sec. 2 (9), (L) pp. 2-4.

Advisory board meetings are held at least annually with the grazing district officers, to recommend action on grazing applications. Applications of advisory board members are acted upon by the administrative officer (formerly grazier, now range manager). Base properties are classified according to provisions of the Federal Range Code.

Grazing permittees are afforded an opportunity to protest adverse action on their grazing applications at a protest meeting before the advisory board and the range manager. If the action on the protest is adverse they may file an appeal requesting a hearing before an examiner. They have right of appeal from the examiner's decision to the Director of the Bureau of Land Management and from the Director to the Secretary of the Interior.[13]

Temporary one-year grazing privileges only were authorized at first. Few reductions in livestock using the federal range were made during the first grazing season. The policy was to advise the operators of future reductions and allow an interval of time for them to make necessary adjustments. As information regarding the grazing capacity of the federal range and the character and amount of base property became substantiated and livestock operations became stabilized through the institution of proper range management practices, term permits for periods up to ten years were issued. These term permits were in conformity with the Taylor Grazing Act and the rules and regulations in the Federal Range Code.

Permits are subject to cancellation at any time because of: (1) non-compliance of the permittee with rules and regulations; (2) loss of control by the permittee of all or a part of the property on which a permit is based; (3) failure of the permittee to demonstrate that actual commensurate rating of the base property upon which it is based is equal to the estimated rating at the time of the issuance of the permit; (4) permittee's failure to make substantial use of the base property; or (5) diminution of forage because of withdrawal of classification of the land for a higher use.

Applications are taken each year during the term of the permit for the annual use that will be made of the federal range.[14] Free use permits are issued to applicants for livestock kept for domestic purposes.

General rules of the range are prescribed in the Federal Range Code prohibiting the unauthorized (1) use of the federal range or stockdriveways; (2) construction or maintenance of range improvements; (3) cutting, burning or removal of vegetation, or the abuse of federal property in any way. Range users must also comply with prescribed rules to bring about better range practices, including those pertaining to branding, trailing, salting, establishment of bed grounds, and the breed, grade, number, and time of turn-out for bulls. Provisions of the state law apply to the latter in the absence of expressed requirements by the Bureau.[15]

Alleged violators of provisions of the Act or the Code are served with written notice. If the violation consists of unlawful grazing of livestock the notice orders the alleged violator to remove the livestock by a specified time. If the terms of the notice are not followed, legal action may be taken or the livestock may be impounded. Usually the alleged violator complies with the notice and makes an offer of settlement for the damages to the federal range or other property. If the offer of settlement is accepted it constitutes satisfaction of

[13] *The Federal Range Code, 1949, op. cit.*, Sec. 161.9, pp. 16-22.

[14] *Ibid.*, Sec. 161.6(c), pp. 8-10.

[15] *Ibid.*, Sec. 161.10, pp. 23, 24.

civil liability. Where grazing permittees are involved in cases of clearly-established flagrant or repeated violations, disciplinary action may be taken by reducing, revoking, or denying the renewal of a license or permit. Before such action is taken, however, the violator is cited before an examiner of the Bureau of Land Management. As in other forms of appeal, the accused may appeal from the decision of the examiner to the Director and finally to the Secretary of the Interior. Violations by nonpermittees are handled through direct action in the federal court.[16]

Grazing privileges within grazing districts have the distinction of being tied to dependent base property.[17] The transferring of these privileges under Bureau of Land Management administration is unique. Operators owning properties without privileges benefit by acquiring privileges through transfer from other properties. Livestock operations may be stabilized by transferring privileges from leased to owned lands or from relatively unproductive to highly productive lands.[18]

Range Improvements

When the Taylor Grazing Act was passed, and the situation is by no means corrected yet, vast areas of the federal range were inaccessible to livestock because of the lack of water. Considerable overgrazing occurred due to congestion of livestock around existing water holes. To alleviate these conditions, stockwater reservoirs, wells, and springs were and are being developed, fences and stock trails constructed, and salt grounds established.

"Last of the Herd," that famous early-day painting by C. M. Russell, eloquently portrays the hazards of winter grazing. Truck trail construction made extensive areas of these winter ranges more accessible for range supervision and handling of supplementary feeds. To assist in healing old erosion scars, prevent new ones, and to increase and improve the forage supply, a program of reseeding was inaugurated on areas of denuded or reduced vegetative cover where conditions of soil and moisture were favorable.

The construction of the range improvements follows a District Range Improvement Plan developed by the range manager in consultation with the advisory board and permittees. Work is done for the most part by contract.

Licensees and permittees now pay a grazing fee of ten cents and a range improvement fee of two cents per animal-unit month.[19] (An animal-unit month is the grazing equivalent per month of one cow or horse, or five sheep or goats.) Exceptions are made in some instances where higher fees are charged on lands administered by agreement.

The range improvement fees are used to construct and maintain the various types of developments required to rehabilitate the federal range and promote its proper use by livestock. These range improvement fees have been augmented to a very considerable extent by contributions from the licensees and permittees in the form of money, materials and labor. This cooperative policy has proved beneficial for at least three reasons: (1) with a financial investment in the improvement project, the range-user takes a more active interest and makes more careful use of the improvements; (2) financial participation by range-users further assures the desirability of the project; and (3) with added funds the improvement program may be carried forth more rapidly. Title to the cooperative improvements goes to the United States Government. Should the cooperator's

[16] *Ibid.*, Sec. 161.11, pp. 24-27.
[17] *Ibid.*, Sec. 161.4, p. 6.
[18] *Ibid.*, Sec. 161.7, pp. 12, 13.
[19] *Ibid.*, Sec. 161.8, pp. 13-15.

use of the project be taken over by another range-user the cooperator may be reimbursed by the new user to the extent of his invested share in the project. Should the project be abandoned, the salvaged materials revert to the parties of interest in proportion to their invested shares.

Another substantial share of range rehabilitation has resulted from range improvement projects constructed entirely by the licensees and permittees under Section 4 of the Act. Such permits are not granted if the project does not further the Bureau's plans for range rehabilitation or range management. Title to such range improvements goes to the permittee.

Fire Control

To cope with the menace of fire, the range manager each year prepares a comprehensive district fire plan. The plan lays out the locations and availability of personnel and equipment and the general system of operation. The core of the plan is a system of per diem guards, most of whom are stockmen-users of the range. Fire fighting tools are stored in strategically located caches and the per diem guard is authorized to recruit and hire fire fighters. In the event of large fires, district personnel supervise, calling on the cooperative services of other agencies, private individuals, and equipment contractors.

For those grazing districts embracing exceedingly high fire hazard areas, such as the cheat grass ranges of South Idaho, the per diem guard system is augmented by a full-time fire fighting organization maintained during the fire season. This organization generally includes a district fire supervisor with an emergency fire crew of temporary wage employees. A continuously-manned short wave radio system is the principal means of communication. Scouting and patrolling of fires is done largely by contracted plan service.

Multiple Use of Public Lands

Rarely, if ever, is any part of the public lands within grazing districts used solely for grazing by livestock. These lands in addition to supplying forage for domestic livestock, graze big game animals, furnish nesting places and general habitat for upland game birds and ducks, and provide fishing, hunting and other forms of recreation. The growing of timber and watershed protection are other important uses. The range manager attempts to balance uses to secure the most desirable combination. Generally multiple uses do not conflict appreciably; however, where uses are not compatible, the most beneficial use or uses, e.g. watershed protection, is determined and the land managed accordingly.[20]

These many uses of public lands are accompanied with a diversity of associated programs, including soil and moisture conservation, land classification, and forestry, each a highly specialized field of its own. Local administrative responsibility for these activities within grazing districts is delegated to the district range manager. In reality he is an area manager. He is the official agent of the federal government for all activities associated with the public lands within the grazing district and on surrounding scattered public lands under his jurisdiction.

Associated Programs of Grazing Districts

The program of soil and moisture conservation in grazing districts and other Bureau-administered lands in the United States is a continuing activity authorized by the National Soil Conservation Act of 1935 (49 Stat. 163). Until 1940, all soil conservation activities under this

[20] Marion Clawson, *op. cit.*, pp. 4, 230.

Act, regardless of land ownership, were administered by the Soil Conservation Service of the Department of Agriculture. On April 11, 1940, the President's Reorganization Plan No. 4 provided that all such activities pertaining to public domain lands under the jurisdiction of the Department of the Interior should be transferred to that Department. Where such activities are essential to rehabilitation of the public lands, soil and moisture conservation work may also be carried on by the Bureau on private lands with the consent of the owners.

Conservation planning and operations of the Soil and Moisture Conservation program are organized on the basis of project areas. These are areas on which rehabilitation and conservation treatment is necessary for the reduction and prevention of critical erosion and the wastage of water resources. Management and operational plans for each area must be prepared and approved before project work may be initiated.

Major techniques used in the soil and moisture program to control erosion consist of range revegetation; construction of diversion and silt detention dams; developing flood irrigation of otherwise dry lands; development of stock watering places providing for better livestock distribution; and the construction of fences also for better livestock distribution and to protect newly reseeded areas.[21]

Effective cooperation from the range users is also an important aspect of the soil and moisture program, since these conservation practices are as much in the interest of the user as of the government. This interest is evidenced by extensive financial contributions by the range-users.

Public lands within grazing districts which have more valuable uses than for grazing may be opened for disposition, settlement, or occupation. First, however, the lands must be examined and classified according to their proper use. If so classified, the lands may then be opened for agricultural homestead entries, exchanges by state or private individuals, sale of isolated tracts under 1,520 acres or un-isolated rough or mountainous tracts under 760 acres, lease or sale of tracts not exceeding five acres for special uses, permits for rights-of-way and oil and gas leases, etc.[22]

Examination and classification may be done by either the area classification method or the case method. By the area classification method large blocks of land are examined and classified in one operation. Detailed physical and economic information is assembled to determine the suitability of these public lands for their various uses. From this survey detailed plans are formed and an action program inaugurated. The public land to be disposed of to private individuals is opened for appropriate land entry. Lands that should be more logically included under state administration or that of another federal agency are so transferred. When an individual applies for a land entry in an area not covered by the area classification method, an examination and classification report is made for that individual tract.

Forestry is a significant part of the resource management program. Tree growth in generally sparsely-timbered areas is highly valued, especially as a source of forest products for local use, for watershed protection, as scenery, and as an adjunct to recreation. Some of the grazing districts possess sizeable stands of merchantable timber. Responsibility for sustained yield management of the timber stands rests with range managers.

[21] *Soil and Moisture Operations*, A pamphlet (Washington: USDI, Bureau of Land Management).

[22] *The Taylor Grazing Act, 1949, op. cit.*, Sections 7, 8, 15, pp. 4-6, and 9.

Prior to 1947, except for an emergency war time Act, there was no statutory authority for the sale of green timber on unreserved, vacant, public lands. Free use permits were allowed under the Act of June 3, 1878, and various other free use laws for house logs, poles, posts or fire wood for domestic use. The Materials Act of July 31, 1947 (61 Stat. 681; 43 USC 1185 to 1187) authorized the sale of timber or other forest products, as well as other materials, from these lands.

Timber to be sold is cruised, marked, and removed in accordance with approved silvicultural practices for sustained-yield and sold at not less than the appraised value. When the appraised value of the timber or other material to be sold is $1000 or less, it may be sold without competitive bidding. Sales involving more than an appraised value or $1000 may be made only to the highest qualified bidder at public auction or under sealed bid.[23]

Free use permits for poles, posts and firewood are still authorized for domestic use. Green trees of sawtimber size may be disposed of under free use permits only when such disposal is in the interest of the government. Free use permits may be issued to federal or state agencies, including municipalities, without limitation as to number of permits or value, provided such materials will be used for public projects.

Coordination with Other Federal, State, and Local Agencies

Administration of Bureau of Land Management grazing districts by virtue of the multiplicity of uses of the public lands has a close relationship to numerous other federal, state, and local programs. Many grazing districts adjoin National Forests, Indian Reservations, Military Reservations, and Land Utilization Projects. Users of the Bureau of Land Management grazing districts frequently also have grazing privileges on one or more of these administratively different areas as well as on intermingled state and private lands. Problems of inter-agency coordination arise as to when the livestock may be allowed on and off these various areas so as to eliminate duplication of time of grazing use by the same animals or to fill gaps in the grazing season. Trailing schedules and routes of trailing must be considered with livestock crossing the lands of one agency to that of another.

Grazing district plans for soil and moisture rehabilitation and conservation must be coordinated with those of other land management and resource development agencies operating in the areas affected. This need for coordination is especially significant since the problem of rehabilitation and conservation is most effectively attacked on a watershed basis. These watersheds frequently contain many different types of administrative areas upon any one of which may depend the success of the project. Futhermore, these plans must be coordinated with other land and water resource development plans, taking into consideration off-site or down-stream benefits.

Within many grazing districts state soil conservation districts have been formed. Cooperative agreements between the Bureau of Land Management and many of these districts have brought joint action on common problems.

The work of the Bureau of Land Management and the Bureau of Reclamation is closely related in many aspects. The watershed significance of public lands, and particularly the siltation problem as related to reclamation development, is a common one. In some areas crop land now serving as base

[23] *Title 43, 1949, op. cit.*, Part 259, as revised in Circular 1758 and published in Federal Register Vol. 15, No. 122 of June 24, 1950.

property for grazing privileges on the federal range has been or may be flooded by reclamation storage reservoirs. When this is the case it is necessary to determine what adjustments should be made. When public domain lands are withdrawn for reclamation purposes the Bureau of Land Management may, with agreement of the Bureau of Reclamation, continue administration of the grazing resources until the lands are required for the development of the reclamation program.

Wildlife management plans within grazing districts are concerned chiefly with the amount of suitable forage to be reserved for game animals during proper seasons of year in the right habitat. Since these game animals roam at will they in a sense come under the administrative jurisdiction of many persons. Various federal and state land management agencies and private individuals supply them with forage which must be properly managed; on the other hand, the states regulate harvesting of the animals. These two interests must be coordinated. Proper balance between the uses of wildlife and domestic livestock and other uses must also be solved.

Protection of forage and timber resources from fire is another program closely related to those of other agencies. Cooperative agreements are made with other federal and state agencies, counties, municipalities and private concerns having fire organizations operating on adjacent lands. These agreements usually provide for the mutual use of equipment and personnel.

The impact of grazing district administration on the local and national economy is best shown by a summary of grazing district accomplishments.

Summary of Accomplishments

Within grazing districts approximately 20,000 livestock operators graze annually approximately 8½ million head of livestock securing 14½ million animal unit months of forage from grazing district lands.[24] This forage is now being obtained without the "cut-throat" competition of pre-Taylor Act days. Responsibility for this favorable change is due to adjustments in the amount of use and the establishment of individual and group allotments for which grazing periods and numbers and class of livestock have been specified. These improved range management practices have spurred the remarkable recovery of weakened and depleted forage resources. Long-term permits have been issued to over 50 percent of the range-users.

A more dependable forage supply on public lands together with a required adequate base of operations has assisted greatly in creating stability of livestock operations dependent upon the federal range.

Range Improvement and Soil and Moisture Conservation Programs have been particularly successful in developing the public lands so that livestock are now making more efficient and conservative use of them; scars of past abuses have been and are being healed and new ones prevented. These programs have also been successful in providing additional forage by opening grazing areas which heretofore were inaccessible to livestock, and by increasing the quantity and quality of forage plants by water spreading, reseeding, etc. As a result, the necessity for a severe reduction in grazing has been eliminated or materially lessened. In some local areas an increase in livestock has been possible. Following is a tabulation of the principal type of development projects the Bureau of Land Management has placed on the federal range since 1935:

[24] *Report of the Director of the Bureau of Land Management 1951, op. cit.*, Tables 75, 76, pp. 96, 97.

PRINCIPAL RANGE REHABILITATION AND IMPROVEMENT PROJECTS 1935 THROUGH 1951
(FISCAL YEARS)

Livestock Watering Places...	9,273 each
Dam, Soil and Moisture Conservation.....	1,088 each
Fencing.....	10,214 miles
Reseeding.....	1,125,872 acres
Brush and Weed Control.....	951,819 acres
Pest Control (rodent & insect)	14,773,846 acres
Tree Planting.....	201,902 each
Corrals.....	521 each
Water Spreaders, Canals, and Ditches.....	781,786 lin. feet
Truck Trails.....	12,122 miles

Grazing district lands also supply approximately 1,172,000 animal unit months of forage which has been reserved by the BLM for the exclusive use of an estimated 723,700 big game animals including antelope, deer, elk, moose, and mountain sheep.[25] In addition, these lands serve as the habitat for large numbers of upland game birds and water fowl. Development of watering places on the federal range has provided for better distribution of big game animals and nesting places for birds. The many reservoirs also serve as resting places for migrating water fowl.

Fire control within grazing districts has made a creditable showing in reducing the number of fires reported annually by an estimated 30 percent and the number of acres burned over by approximately 60 percent since 1941. A major accomplishment is the reduction in the number of large fires and also the number of man-caused fires. Much forage, timber, and soil are represented in this saving.

There are still approximately 225,000 acres burned over annually, representing a loss of resources the nation can ill afford. The improving vegetative cover resulting from management and improvement programs creates an increasingly serious fire hazard. A more intensive pre-suppression program, more and better equipment, and increased manpower are required to cope with this problem and to reduce the acreage burned over annually. Annual appropriations to cover costs of fire control have averaged approximately two mills per acre.

During fiscal years 1942-51, nearly five million acres of vacant, unreserved public lands were included in over 13,000 applications for entry under the Taylor Grazing Act. Of these lands over 65 percent were classified as being suitable for disposition. Applications for these lands were primarily for homestead, public sale, exchange, and desert land entries. In addition to the above classification of lands by the case method, over 7.9 million acres in the Missouri River Basin have been classified by the area classification method. Of these areas, approximately 4½ percent were classified as suitable for disposition. The lands so disposed of have generally been placed to a higher use and in most instances the land pattern of the public lands has been improved, providing for better administration.[26]

The advisory board system of the Bureau of Land Management deserves real credit for these accomplishments within grazing districts. The combined membership of these boards made up a vast wealth of knowledge of the range, much of which could not have been obtained elsewhere regardless of time or money.[27]

When the regulations were being formed, their application was reviewed by the board members and changes suggested to make them more workable. With benefit of such advice the administrators were better able to weigh the

[25] *Ibid.*, Tables 77A, 77B, p. 98.

[26] *Ibid.*, Tables 57, 58, pp. 74, 75 and corresponding tables from this same report for the years 1942-50.

[27] Marion Clawson, *op. cit.*, pp. 248, 249, and 368-376.

pros and cons of different administrative actions and select those which would obtain the desired results with least disturbance to the program. With such advice from the National Advisory Council on matters of a national scope, from the various state advisory boards on matters of state-wide concern, and on district-wide matters from the district advisory boards, better policies, regulations and administrative decisions undoubtedly resulted.

The wide variability in the character of the public ranges requires detailed knowledge of innumerable localized areas. Advisory boards with their widespread representation were able to supply this in accurate detail. Thus they were able to make wise recommendations on best locations of proposed range improvement and soil and moisture projects at considerable time and financial savings to the government.

They supplied substantially accurate estimates of the federal range's carrying capacity which were utilized until technical range surveys could be made. They advised who had made grazing use of the public lands, when and to what extent. This information, otherwise unavailable, was essential in determining the qualifications of base properties and the equitable distributions of grazing privileges.

Through their functions as Advisory Board members the stockmen became better informed of the purposes and administration of the program. Because of this, criticism and misunderstandings due to misinformation were largely eliminated.

Advisory Board members have become familiar with the operation of this segment of government and are outstanding examples of citizen participation in government—a great source of our nation's strength.

Economic Status of the Chinese Peasants after Agrarian Reform†

By SHAO-ER ONG*

THE great success of agrarian reform and the rising level of peasants' living standards are being published in reports from Chinese Communist press. The reliability of these reports deserves examination. For this reason, the purpose of this study is to seek the answers to the following questions: (1) What is the Communist solution to China's land problems? (2) What is the actual situation of agricultural taxation in Communist China? and (3) What is the economic status of the Chinese peasants after agrarian reform?

Solution of Land Problems

For a long time China has been known as having many complicated land problems. The small-sized farms with fragmentary plots, the unequitable distribution of land ownership, the employment of centuries-old farm practices, and other factors all constitute obstacles for the modernization of agriculture.

The Chinese Communist Party has offered a solution: redistribution of land by class struggle. This solution was motivated by two objectives, political and economic. Politically, the Party hoped to obtain hearty support from the poor peasants by its policy of forcible redistribution of land. This policy was based on the reasoning that peasants needed and wanted land and that, if given land by forcible redistribution, they would need future protection against possible retaliation from that portion of the landlord group which might survive the class war. Thus, through agrarian reform the Communist Party hoped to gain control over the peasantry. Economically, the Party desired early industrialization in China. The Communists reasoned that after the completion of land redistribution all tillers would own land and would therefore work harder and produce more. If production could be increased, agriculture would be in a position to supply more raw materials and accumulate capital for industrialization and would also provide a greater market for industrial products. This is why Mao Tse-tung, Chairman of the Chinese People's Republic, considered agrarian reform as one of the top priorities in his civil programs in 1950.[1]

One of the important steps in carrying out the agrarian reform was to differentiate the peasantry into five classes: namely, landlords, rich peasants, middle peasants, poor peasants, and farm laborers. The differentiation was based on the Marxian principle of labor and exploitation.[2] So far there are no available statistics published in the Communist press on the percentage of farm population for each class. It is merely a guess that the landlord class might constitute less than 10 percent of the farm population while the poor peasants and farm laborers combined, 40 percent. It is also a guess that this landlord class possess approximately from 30 to 50 percent of the land.

† This study was made under the direction of Professor Theodore H. E. Chen, Head of the Department of Asiatic Studies, University of Southern California, to whom the author is indebted for valuable suggestions and criticism.

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[1] Mao Tse-tung, "Report to the Party Plenum," *People's China* (The only official English biweekly, Peking) Vol. II, No. 1, July 1, 1950.

[2] Documents on Rural Class Status Differentiation, *People's China*, Supplement to Vol. II, No. 2, July 16, 1950.

To standardize the procedures for putting this type of agrarian reform into effect, an Agrarian Reform Law was promulgated by the Peking Government on June 28, 1950.[3] It aimed at: (1) the elimination of the landlord class; (2) the preservation of the rich peasant economy; (3) the protection of the middle peasant class; (4) the redistribution of land for poor peasants and farm laborers. The Communist strategem for carrying out such a reform was to rely mainly on the poor peasants and farm laborers, unite with the middle peasants, neutralize the rich peasants, and eliminate the landlord class.

Poor peasants and farm laborers in the eyes of the Communists were the most active and steadfast elements in the progress of the class struggle. After the accomplishment of the agrarian reform a large part of the poor peasants and farm laborers could possibly become middle peasants. Thus, for the good of the Communist Party, all middle peasants must be absorbed into peasants' associations. If the rich peasant economy could be protected from infringement, according to the Communist reasoning, it would tactically protect the middle peasants more effectively and leave the landlords entirely isolated. In case the four classes could stand together, the landlords would be politically isolated and would tend to be less stubborn in their opposition to the confiscation of their land and property.

By observing such a strategem, this class-struggle type of agrarian reform in the past three years has turned the yellow land red, and soaked it in the blood of tens of thousands of murdered landlords in the name either of exploiting and oppressing poor peasants or of committing reactionary activities. According to the latest report, agrarian reform in China has reached the final stage.[4] In the Northwest China Region, because of its early occupation, land reform had been completed before 1950; in the North China Region, it was completed recently; in the Northwest China Region, it has been about 85 percent completed; in the Central-south China Region, 81 percent; in the Southwest China Region, 81 percent; and in the East China Region, 90 percent. Areas affected by this reform as stated in the same report cover more than 350 millions of farm population.

The results of agrarian reform are of both politcal and economic significance. Politically, the Communist Party made big talk of siding resolutely with the peasants throughout the whole reform program. The fall of the landlord class and the rise of the poor peasants and farm laborers have given the Party considerable support, which ought not to be underestimated. By means of the peasants' associations, the farm population has been organized and mobilized. Peasants' representatives have been invited to attend the Chinese People's Political Consultative Conference and other public occasions. Much is done to impress the peasants that, whereas in the past they were oppressed people, they are now the new masters of the land.

Economically, this reform has brought different impacts on the different strata of the farm population. To landlords, it has meant a death blow. They have nothing to expect except grief and sorrow. As regards the rich peasants, theoretically, they could hold their land and property without infringement. Practically, they require partial readjustment. It is stipulated in Article 6 of the Agrarian Reform Law, that in certain special

[3] The Agrarian Reform Law of the People's Republic of China, promulgated by the Central People's Government Administration Council on June 28, 1950, *People's China*, Supplement to Vol. II, No. 2, July 16, 1950.

[4] Report on the Progress of the Agrarian Reform in China, *Jen Min Jih Pao* (*People's Daily*, Peking) July 5, 1952.

areas, part or all of the land rented out by rich peasants may be requisitioned with the approval of the people's government at provincial or higher levels. To middle peasants, land reform has supposedly meant no change in land ownership at all. Those who gained most from the land reform are the poor peasants and farm laborers. Their gains are as follows:

(1) *Free Land and Working Capital.* In the past, due to the fact that capital accumulation of the Chinese farm was slight it took a long time, if at all possible, for a person to climb the agricultural ladder from farm laborer to land owner. The reform enabled poor peasants and farm laborers suddenly to become owners of land.

(2) *No Rent to Pay.* Poor peasants in general were either tenants or part owners. They usually had to pay rent to landlords annually at from 15 to 70 percent of the main crops, varying with the quality of land, amount of aid received from landlords, and kinds of rent such as cash rent, crop rent, and share rent. When they become owners, they of course cease to pay rent, gaining thereby.

(3) *The Abolition of Debts.* According to the new Regulations on Rural Debts,[5] all debts of peasants to landlords which were incurred before the "liberation" are nullified. Though official data concerning the total amount of outstanding debts in the rural areas are not available, the abolition of such debts would certainly give the debtors relief.

Two points should be kept constantly in mind in connection with the agrarian reform. First, land redistribution cannot increase the physical supply of land. It is merely a re-allocation of agricultural resources from one class of people to another. Secondly, land redistribution itself does not necessarily increase agricultural production. The re-allocation may render service for better land use, but may also render disservice if the size of farms becomes too small. Production increase depends largely on a sound land utilization program after resource re-allocation.

[5] Regulations on Solution of Rural Debts in the Newly Liberated Areas, promulgated by the Peking government on October 20, 1950.

Situation of Agricultural Taxation

A problem which deserves study is to determine whether the peasants can make a better living from farming after the agrarian reform. To solve this problem, it is necessary to compare the agricultural taxation during the various periods of the agrarian reform.

The Situation in 1950. Since the Peking government was formed on October 1, 1949, the actual evaluation of the situation of agricultural taxation should start with 1950. During that year there were two major systems of agricultural taxation in China as far as the tax rate structure is concerned. In the "old liberated areas," including the Northeast China Region, the North China Region, and a part of the Northwest China Region, the tax rate was proportional to the yield, i.e., the rate remained constant. In the "newly liberated areas," including the East China Region, the Central-south China Region, the Southwest China Region, and a part of the Northwest China Region, the tax rate was progressive according to the yield, i.e., the rate increased as the base increased. Since the agrarian reform had been completed in the "old liberated areas" before 1950, it is difficult to compare the economic status of the peasants before and after the agrarian reform in the same area and in the same year. For this reason, the comparison presented herewith centers attention on the "newly liberated areas."

A set of "Provisional Regulations on Agricultural Taxation in the Newly Liberated Areas" was promulgated by the Peking government on September 5, 1950.[6] Instead of the old method of agricultural tax collection based on the assessed value of the different grades of land with proportional tax rate, the new method of tax collection was based on the estimated agricultural income with progressive tax rates. The estimated annual production is calculated in terms of the principal crop of a locality such as rice in South China and wheat in North China (referred to as "major grain" in future reference). Other kinds of crops are converted into "major grain" for calculation purposes. The main difference between the old and new methods is that the former treated agricultural taxes as property tax while the latter, as income tax. The new method of calculation used the average estimated agricultural income per capita of the agricultural population within a farm household as a tax base. The larger the number of agricultural population in one household, the lower was the tax base. As under the Kuomintang Government, taxes were still collected in kind instead of cash. The taxes were collected twice a year. In some areas, due to special conditions, they might be collected once a year.

There are two points of weakness regarding the new method of tax collection, which should be considered. From the administrative point of view, if taxes are to be collected according to determined tax rates, it is necessary to have accurate lists of land surveys and production estimates. The old lists of land ownership in China were either obsolete or lost during the war. For this reason the Communists have tried hard to prepare new lists of land surveys and production estimates.[7] Nevertheless, such preparation takes time. Before the new lists are completed, collection of taxes according to the determined tax rates is without base and may lead to wrong estimates.

Uniform tax rate for each tax class is another point of weakness because it works out unfairly for peasants who raise different crops. For instance, cotton and rice are competitive crops. In the tax calculation for 1950, both were used as "major grain" in each area. If the price of cotton was higher than that of rice in that year, the cotton producers would be financially better off than the rice farmers in the same tax class. The reason is that after taxes the actual amount of cotton held by the cotton producers could command higher purchasing power than that held by the rice farmers.

Article 12 of the Provisional Regulations provides a list of progressive tax rates in 40 tax classes. Taxation began with a minimum of 150 *shih chin*[8] of "major grain" per capita at a regular tax rate of 3 percent. The maximum regular tax rate was 42 percent of the estimated per capita income. In addition to the regular tax for the central government, local governments were permitted to collect 15 percent of the regular tax in 1950 as local revenue.

A few points of significance regarding the impact of agricultural taxes on different strata of peasants should be noted. To landlords, victims of the "New Democracy," taxes mean only another threat. The abolition of debts,

[6] Provisional Regulations on Agricultural Taxation in the Newly Liberated Areas, *Ta Kung Pao* (an influential daily newspaper in Shanghai), September 7, 1950.

[7] The efforts of the Communists in struggling for early completion of land surveys and production estimates can be seen in the following documents. "Decisions Regarding the Standards in Determining the Land Acreage and the Annual Normal Production for Agricultural Taxation," *Ta Kung Pao*, September 18, 1950. "Struggle for the Determination of Agricultural Land Production in North China within Two Years," *Jen Min Jih Pao*, June 24, 1951. "The Outline for Carrying Out the Work of Land Surveys and Agricultural Production Evaluation in the Agricultural Taxation Work," *Jen Min Jih Pao*, July 5, 1951.

[8] One *shih chin* is equal to 1.1023 pounds.

the reduction of rent, and the confiscation of land and property were enough to end the era of the landlord class. As regards rich peasants and middle peasants, they received no actual benefits from agrarian reform but carry heavier tax burdens. According to the Provisional Regulations these two groups were supposed to pay from 21 to 31 percent of their estimated income per capita as taxes, much higher than that of the past, which never exceeded 15 percent of their total income.

Poor peasants and farm laborers fared no better. As part-owners or tenants in the past, they paid no taxes but only rent. It is true that, in 1950, rent reduction and debt abolition gave them considerable relief, but it is possible that all these advantages could be offset by the new provision that they have to pay both rent and taxes. Article 10 of the Provisional Regulations provided that on "land for which the reduction of rent and the payment of rent are both carried out according to the Law, taxation of both the landlord and tenant shall be calculated on the basis of their respective incomes."

Situation in 1951. Agrarian reform started immediately after the winter harvests of 1950 in the "newly liberated areas." The Communists assumed that after agrarian reform large land holdings would be eliminated and poor peasants and farm laborers would then be promoted to the status of middle peasants. For this reason, a new list of tax rates was issued for the districts in the "newly liberated areas" where agrarian reform had been carried out in 1951.[9] The new tax rates were divided into 20 tax classes with 150 *shih chin* of "major grain" per capita as the initial taxable point and 1450 *shih chin* per capita income as the highest limit. The tax rate for 150 *shih chin* was 6 percent and for 1450 *shih chin*, 24 percent. In districts where agrarian reform had not been carried out, the "provisional Regulations of 1950" were still in effect except that the local surtax rate had been raised from 15 percent of the regular tax to 20 percent.

A careful examination of the new list of tax rates leads us to think that after the bloody agrarian reform the large landowners are practically eliminated. Probably there are not many farms left which can produce more than 1450 *shih chin* of "major grain" per capita. As a result of land redistribution, small farm economy will become prevalent in all reformed areas.

By comparing taxes paid by the peasants before and after agrarian reform in 1951, it is significant to note: (1) Peasants in low income per capita group paid higher taxes after agrarian reform in the same "newly liberated areas" and in the same year. The Communists were probably trying to get "more feather with the least squawk" on the ground that the poor peasants and farm laborers who receive land and working capital without cost would not complain too much about paying higher taxes in the first year. As a matter of fact, after agrarian reform the majority of farm households fell into the low income per capita group. With the increase of tax burden for this group from 5 to 8 *shih chin* of "major grain" per capita, the total collection of agricultural taxes in kind would mark a sharp increase. (2) Although this low income per capita group was to pay higher taxes in 1951 than in 1950 and higher also than the similar groups in districts where agrarian reform had not been carried out in 1951, the total amount of taxes based on the tax rate list could possibly be less than the amount of rent which

[9] Provisional Regulations on Agricultural Taxation in 1951 of the Districts After Agrarian Reform in the Central-south China Region, *Nan Fang Jih Pao* (*Southern Daily*, Canton), November 14, 1951.

these groups had to pay before. If a part of the peasants in this group had been independent owners in the past, they would certainly have had to carry much heavier tax burdens. (3) Peasants in the upper limit income group enjoyed a little reduction as compared to that of the districts where agrarian reform has not yet been carried out. But if the amount of taxes is compared with that of 1950, the actual burden of the higher income per capita group is just about the same.

Situation of 1952. Two drastic changes were introduced in agricultural tax collection for 1952 after agrarian reform had reached the final stage.[10] The first change is discontinuation of the local surtax. With this change, agricultural taxation became a direct tax of the central government. The second change is that the tax rates were again revised. These two changes were supposed to simplify the procedure of tax collection and calculation, reduce the cost of administration, and also reduce the burden of the peasants.

It may be pointed out here that in 1951 the Peking government collected more revenue from the city bourgeoisie by heavy taxation. At the same time the peasants, particularly the new landowners, found their farming unprofitable. The increase of city revenue and the unfavorable reaction in the countryside may be the main reason which induced the Peking government to reduce the agricultural taxes for 1952. The amount of tax reduction according to this directive range from 1 to 10 *shih chin* of "major grain" per capita for the low income group, and 11 to 73 *shih chin* per capita for the high income group. If the local governments observe strictly this directive and do not collect any surtax, it is possible that the tax burden of peasants will be lightened.

The tax situation from 1950 to 1952 presented in this section is based on the official lists of tax rates. Information obtained from both Communist and non-Communist sources indicate that there are serious deviations. For instance, when rural cadres collect taxes, they do not follow the determined tax rates but base their collection on the "assigned quota" set by the higher authorities. The central government figures out the revenue from agricultural taxation in one year and assigns tax quotas to each province. The provincial government allocates an "assigned quota" to each county. By the same token, the county government determines the quota for each *hsiang*.[11] Finally the cadres in each *hsiang* have to force the peasants to fulfil the quota. In many places the cadres overestimate the agricultural income. Moreover, local governments collected heavier surtaxes in 1950 and 1951 than the tax rates granted by the central government. If such deviations become general, the peasants will unquestionably have a heavier tax burden. Such deviations, however, are difficult to measure.

Economic Status of the Peasants

Agrarian reform by means of class struggle may politically offer a temporary comfort to a group of land hungry peasants and economically benefit the poor at the expense of the rich. A greater success of such reform could be achieved if land redistribution should be carried out in such a way that (1) the resources taken from the rich could provide adequate facilities for production and (2) the resulting net income of all peasants after agrarian reform may be sufficient to improve farm practice and to

[10] A Directive Regarding the Work of Agricultural Taxation in 1952, promulgated by the Peking government on June 16, 1952, *Jen Min Jih Pao*, June 19, 1952.

[11] A *hsiang* may cover only one village or many villages.

cover living expenses. The present economic status of the Chinese peasants may be evaluated in the light of these two points.

Adequacy of Resources. Since the property of rich peasants and middle peasants is supposed to be protected from infringement in the process of agrarian reform, the property of landlords will become the major resource for redistribution. Article 11 of the Agrarian Reform Law states that the unit for distribution of land shall be the *hsiang*, or administrative village corresponding to a *hsiang*, and that within this unit it will be distributed in a unified manner according to population. Accordingly, many poor peasants can receive more benefits in case they live in a *hsiang* where landlords are many and own large land holdings and working capital. Other poor peasants cannot get much from land redistribution in case they live in a *hsiang* where the landlords are few.

A study made by a Communist economist in North China covering five villages brought out the alarming fact the peasants did not receive adequate productive resources after agrarian reform.[12] In these five villages, 112 households which constituted 9.4 percent of the total farm households showed no interest in production; 740 farm households (61 percent of the total farm households) had no animal labor; 637 households (53 percent) were lacking in important implements; 165 households (13 percent) were lacking in man labor; and 178 households (15 percent) owned too little land averaging less than one *mow*[13] per capita, while 47 households owned only a half *mow* of land. With the present man-land ratio, redistribution of land will no doubt result in a small farm economy. Can the peasants be satisfied in the long run with such tiny-sized farms which can not be operated profitably?

A way to develop prosperous small farm economy would be to improve the farming methods in order to increase the maximum output per *mow*. The present agricultural policy in China obviously emphasizes this point by encouraging farmers to invest more capital and labor in order to boost output. The success of this policy depends largely on the relevant supply of labor and capital. However, the conscription of strong young men from rural areas into the Red Army, the elimination of the landlord class who were the major source of farm credit and the collection of heavy taxes all constitute obstacles in making the policy effective and may bring results which are not so rosy as has been presented by the Communist press.

Other disadvantages of small farm economy have also been discovered by a Communist Party leader who made a study in Honan province after agrarian reform.[14] In his report he indicated that the weaknesses of small farm economy such as conservatism, decentralism, difficulties in technical improvement and in enlarging the acreage of economic crops, were all prevalent in the areas studied.

There is a possibility that some unknown percentage of peasants may have received adequate resources after agrarian reform. This group of beneficiaries may support heartily the production drive in order to express their gratitude toward the Communist Party. Some rich peasants and middle peasants whose property is protected from infringement may also work harder to express their gratitude. As a result, these peasants could harvest more than other groups and might increase their farm earnings.

[12] Min Wan-lan, "The Agricultural Production in the Old Developed Areas," *Hsin Chung Hua*, (New China Monthly, Shanghai) Vol. XIV, No. 13, July 1, 1951, p. 20.

[13] One acre is equal to 6 *mow*.

[14] Chang Hsi, "The Rural Situation in Honan Province After Land Reform," *Jen Min Jih Pao* (*People's Daily*, Peking), March 12, 1951.

Under the condition of free competition in agriculture, the better may become the best and the worse worst. Eventually the re-emergence of the previous rural class stratification will become inevitable. For this reason the Communists sent a group of investigators to make a detailed survey of an area in Shansi province where agrarian reform was first applied five years ago.[15] This group made a striking report to the effect that about 20 percent of the peasants had become poor again, and an equal percentage "obviously wealthy." If such trend continues, a question will rise for the Communists: Would it be necessary to start another agrarian reform in order to equalize rural wealth after a certain length of time?

It is reasonable to say that agrarian reform of the class-struggle type is not a panacea to solve China's land problem. To improve the man-land ratio in China depends more on the shift of farm population into industry than on keeping them in the farm. Though the Communist agrarian reform does show some political advantages, the economic disadvantages may have, to a certain extent, offset them.

Amount of Income. Attitude toward agrarian reform among peasants depends on whether they are beneficiaries or non-beneficiaries. Beneficiaries may sympathize with the Communist approach to use the ruthless method of land distribution by killing so many people. Although the majority of them do not receive adequate resources yet they receive a certain amount which is better than none. The crucial question is: Do they improve their economic status?

The tax rates for 1952 are lighter than those of the preceding two years. The majority of the beneficiaries fall into low tax classes. Certainly they could reach higher tax classes if they received large benefits from redistribution or exhibited superior ability of management to increase production. As mentioned above, this estimated agricultural income includes annual normal production of all crops in terms of "major grain." If agricultural income is calculated in such a way, any extra income made by the peasants would constitute only a minor part of the total income. Examining the estimated income per capita among the low tax classes after tax, one finds that the actual amount of "major grain" per capita ranges from 350 to 600 *shih chin.* Assuming that the "major grain" is rice and figuring the average consumption per capita of rice in China is more than one *shih chin* a day, one finds that this amount of income per capita is barely enough to maintain the minimum necessity of a person and the cost of operation. The situation in 1950 and 1951 was even worse than that of 1952 because the tax rates were higher. Should there be extra surtaxes, contributions, donations and deviations, the financial position of the beneficiaries would become darker. In the light of tax payment, the economic status of the beneficiaries after agrarian reform does not show much improvement over their previous status as tenants and farm laborers.

As non-beneficiaries—the middle peasants and rich peasants—their financial position does not look brighter even though they earn higher income per capita. Besides taxes, they have to pay extra contributions and donations which will absorb most of their net income. The purchase of Victory Bonds in 1950, the contribution to the "Chinese Volunteers" in Korea, and the donations for the purchase of airplanes and heavy artillery for the Korean war in 1951 have skimmed most of the economic fat from these two groups. When the Peking

[15] Report on the Effect of Agrarina Reform in Shansi, *Jen Min Jih Pao*, November 11, 1951.

government launched a systematic and patriotic campaign of paying agricultural taxes in 1951, an editorial in *People's Daily*[16] acknowledged that the collection of agricultural taxes would meet with many difficulties. The reasons given were: (1) the tax rates had been raised; (2) after agrarian reform, the tax would be paid directly by new owners who had not paid taxes before; and (3) having donated much of their grain for the purchase of airplanes and heavy artillery, the peasants might not have much grain for the regular tax. This official acknowledgement of the third difficulty may be evidence of the serious effects of the heavy contributions and donations on the rural economy.

The new regulations of 1952 abolished all surtaxes but did not say a word regarding the prohibition of collecting contributions and donations. If the Peking government continues to collect contributions and donations, reduction of taxes would not improve the economic status of the peasants. As far as the findings of this study are concerned, the results of agrarian reform in China in the past two years may have benefited the Chinese peasants in some ways, but the net income of the peasants after taxation does not make possible a better economic status for them.

[16] Editorial, *Jen Min Jih Pao*, November 11, 1951.

Among Articles to Appear in May 1953 issue of Land Economics

Land Redistribution and Industrial Development.....V. Webster Johnson *and* John E. Metcalf

Cost of Capital Techniques Employed in Determining the Rate of Return for Public Utilities.....Lionel W. Thatcher

The Natural Gas Industry: An Economic Analysis of Public Policy.....Dudley F. Pegrum

Mechanics of the Urban Economic Base: Historical Development of the Base Concept.....Richard B. Andrews

Housing Design and Social Relations.....John P. Dean

Fundamentals of Resource Ownership Policy†

By EARL O. HEADY*

MANY farm families place farm ownership high in their means-end scale. While not all attempt to purchase a farm, the majority of operators in the United States start with ownership of land as well as other resources in mind. It is true, of course, that there are few operators who are never owners in in the sense of having title to some machinery, livestock, and monoperiod resources. But most beginning farmers extend their vision to ownership of buildings and land resources as well.

National and state production policies long have been directed at farm ownership. The marketing system employed for publicly-owned land was in this direction (although it also was directed towards goals other than ownership). The homestead act wherein farmers were given title for living on and operating a specified acreage was another step in this direction. The preemption act and the low price at which other segments of the total stock of land were disposed represented similar steps. Other state and federal policies have been in the same direction down through time. Low interest rates under the Federal Land Bank System have been partly for this purpose. The attempt to allow low-capital tenants to become owners under the tenant purchase program of the Farmers Home Administration has been another step in this direction. In some states, real estate taxes are scaled to favor owner-operation of farms. Attempts to establish a large number of small ownership units have been more extreme in other parts of the world. In postwar years, "land reforms" in Eastern European nations, Japan, South Korea, and Italy have resulted in the confiscation of large landed estates and the redistribution of these among the peasants. "Land reform" in Italy has also included use of a graduated land tax to discourage large farms. The Liberal Government of New Zealand employed a similar tax as early as 1893 to bring about "closer settlement."

Objectives of Analysis

In order to add to the literature on the economics of farm ownership, we attempt to set forth in this paper an analysis in production economics. Our interest is in outlining a frame of analysis which we believe is highly relevant to the problem. The analysis sticks closely to purely fundamental economics and touches only lightly upon sociological and related aspects of farm ownership. We are aware, of course that sociological, legal and economic aspects are all involved in ownership. However, it also is necessary and worthwhile that these particular elements of the problem be recognized and subjected to individual analysis. True scientists, interested not only in farm ownership but also in objective analysis, will agree that fundamental logic can help remove part of the "religion" which has surrounded the topic. It is through the ability and freedom for all issues of science to be investigated that material progress is truly made. We hope that this statement can both complement and extend the analysis which has been made in other writings.

Some agriculturally-minded people have taken farm ownership as an end

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per se and have directed their efforts largely towards retaining or increasing the number of people on farms and the number of owner-operated farms. Any increase in the number of rented farms or the acreage of rented land is taken to be "bad." Sometimes the precedents of history are set forth and "agrarian principles" are cited as the basis and as the justification for pursuing "the end of owner-operation" to its extreme limits. Even farm economists have been known to "raise a brow" at purchase of farms by city people since this development excludes the possibility of ownership by the man who operates the farm. Church bodies, farm organizations and other rural-oriented groups also support farm ownership in the vein of an "ultimate end." We thus need to inquire whether farm ownership is a means or an end and the conditions under which it becomes either. Obviously, ownership ranks high in the minds of a large number of people. Yet why do industrial workers and society in general not insist that the "non-farm worker must own his own tools?" If the ownership principle is carried to the extreme, there is no reason why the product of non-agricultural industries could not be produced under a handicraft system in the homes of the workers. At one time in world economic development this was the chief "production and resource use" pattern of all non-farm industries. Even now it constitutes an important fraction of production in some oriental nations. Is there any basis to cause ownership of the factors of production to differ between agriculture and non-agricultural industries? Do the ends of production or resource use differ so drastically that a unique line must be drawn between agriculture and non-agricultural industries?

The desire to own land as an inflation hedge, or as a basis for security from political instability and from the ravages of war, is not explicitly discussed in this paper. It is a crucial issue, and one of the major motives for the ownership of land by non-operating owners. The motives that lead "city owners" to buy farms are not always associated with increased capital resources devoted to agriculture nor with a greater economic product, nor maximum total welfare. This is true in the United States, and much more so in many foreign countries. "Income security" is not the type of security that has led many peasant societies to place values on land ownership that often seem to the United States student to be absurdly high. Rather, it has been a desire to survive. The "security" that different societies seek in land ownership is not a uniform thing.

The Ends of Resource Ownership in Agriculture

The viewpoint of production economics is that of using resources in a manner which allows the fullest possible attainment of individual, family or community ends. Welfare (utility) maximization becomes the "common denominator" of ends in economics. Is farm ownership then an end coincident with utility itself? It is important that we determine whether farm and non-farm segments of our society view ownership as an ultimate end which has priority over all other ends. Were this true then the direction is obvious. We should immediately set out to get more families into agriculture and to make farm owners of them. True, this effort would eventually lead to a very large number of small low-income farming units. With farm ownership as the paramount end of society, the resulting low-income environment would be acceptable, however, over all alternative arrangements of resources. Ordinarily, utility is maximized not if one choice is made at the exclusion of all others but

only as the optimal combination of several competing ends is selected.

While it is true that many popular, semi-popular and some academic discussions in economics suppose that farm ownership is an ultimate and paramount end, more likely it is a means to an end in the great majority of cases. Certainly it should be examined in this light. If it appears that the strong support and emphasis given to farm ownership actually stems from the process as a means to other ends, then we should analyze the ends to which it is directed. Are there substitute means to the same ends? Are these substitute means or arrangements which are acceptable also efficient in furthering the ends which farmers attempt to attain through farm ownership?

Ownership as a Means. In the great majority of cases, farm ownership is or can be a means to the attainment of "higher" ends (which, in turn, become means directed toward even more remote ends). First, with the historic and individualistic system of capital accumulation in United States agriculture, the ownership of a farm has become a means of providing an income flow in the retirement period of farm families. The farm is "the annuity of agriculture" and while income is highly uncertain and variable when viewed *ex ante* in years remote from retirement, it is the system of investment which farmers best understand. They reinvest their savings in farms rather than in the securities of other industries. Perhaps it is the paucity of knowledge of returns from non-farm investments which causes them to view "outside investments" with a high degree of uncertainty. Second, farm ownership can be a means to farming efficiency even when efficiency is measured in operator profits. This statement applies to the leasing systems typically found over a wide range of American agriculture. The owner-operator often realizes greater returns than a tenant from a given collection of resources because of the distortion which the lease causes in production possibilities at a given point in time and over time.[1] Under these conditions, ownership becomes a means to a greater money income and higher level of living. Arthur Young's adage, "the magic of property turns sand into gold," is partly a reflection of these imperfections in the resource service market. Farm ownership also provides a means whereby the individual family can adjust the use of resources over time to conform with its own time preference. The short stay or the leasing regulations on rented farms may require that the tenant extract only a limited amount of productive services from the soil. The owner who is not inhibited by the stipulations, interests and decisions of a landlord can farm his land as severely as he pleases if he or his family places a high value on early as compared to later incomes.

Farm ownership is also a means to security in modes of family living. Since the farm home is physically joined to the producing unit in American agriculture, farm ownership allows the farm family to build and develop its home in the manner of any other home owner. Direct utility is attached by most families to the home which they own. Through home ownership they are able to decorate the house, landscape the grounds and add the modern conveniences which today are characterized as "necessities." Where the farm family must move every few years, or is faced with the uncertain

[1] For a detailed discussion of these points, refer to Earl O. Heady, "Economics of Leasing Systems," *Journal of Farm Economics*, August 1947, pp. 659-678; Earl O. Heady, "Share Leases and the Inter-Product Allocation of Resources," *Southern Economic Journal*, January 1952, pp. 361-373; and Heady and Kehrberg, *Relationship of Share and Cash Leases to Farming Efficiency*, Iowa Agricultural Experiment Station Bulletin 386.

prospects of moving, it has little opportunity to expend time or money in developing the items of consumption such as running water, electricity and other goods which attach to the home and give off a flow of utility or satisfactions. These problems are less acute in some European regions since farmers live in village communities and travel each day to their farms or farming plots. Under this system it is possible for the family to enjoy the satisfactions which attach to home ownership without resort to ownership of the land resource as a part of the business firm. (In many of these cases, however, the majority of the farm families do own the farm land which they operate.) Farm ownership as a means to home satisfaction has not been so important in England where an important percentage of farms has been in the estates of wealthy families. The major portion of these has been rented to the same tenant family for one or several generations; the tenant is able to develop conveniences and household amenities as if he owned the farm. In contrast, the United States tenure system, with its great degree of uncertainty, has caused farm families to place high values on farm ownership as a means to the ends of home security and greater family welfare. (The industrial worker can own his home without owning the resources with which he produces.) The "consumption items" which are important include not only home beautification and the opportunity to install electricity, running water and other conveniences but also include the ability of the family to be secure in the community which it selects for a home. Frequent farm moves require that the family uproot itself from the church, the community, the school and other organizations which provide direct satisfaction to the household. In this sense, farm ownership or tenure security may also become a means to community stability and the democratic participation of farm families in public affairs.

Ownership also may be looked upon as a means to freedom (with its various connotations). This aspect of ownership weighed heavily in the minds of original settlers in the United States. They were only shortly removed from repressive feudal estates wherein their position was one of subjugation; the tenant was both politically and socially subservient to persons between him and the king in the feudal landholding hierarchy. Personal freedom was also lacking for workers and tenants on estates such as those of William Penn and the large nineteenth century estates of the southern gentry. The political environment has changed so greatly, however, that this facet of resource control has little direct importance to the United States. From this standpoint, the political environment is more important than ownership considerations. Ownership of small plots in dictatorial nations does not give rise to freedom and democracy.

Farm Ownership as an End. Consideration of farm ownership as an end in and of itself is pronounced among such religious groups as the Amish farmers of Lancaster County, Pennsylvania. These farmers look upon themselves as stewards of the soil and ownership is given a high value for this reason. At some level, however, farm ownership is competitive with other consumption goods for most farm families. In many instances the farm family must decide between the alternatives of (a) hiring the resources from which it obtains services and in having a greater money income, or (b) owning the resources and enjoying the direct utility of factor ownership, but having a smaller money income. As competing goods it is unlikely that ownership and goods purchased with money

income substitute at constant rates. A systematic framework can be provided for choices of this nature.

Let us suppose that, in Figure 1, resource ownership as a good on the level of consumption (e.g., ownership either as an end *per se* or as a direct contributor to ends which attach to it alone) can be measured on the horizontal axis while money income or goods which can be purchased with money income can be measured on the vertical axis. The value or preference system of the individual, family or community can then be represented by the use of a conventional indifference curve system. Curve MB is such a curve indicating the relative value placed on ownership *per se* as compared to money income or the goods which can be purchased with money income: the greater is the slope of the indifference curve, the greater is the value attached to ownership as an end or good (e.g., the greater is the rate at which ownership substitutes for money income with the level of welfare given). The goal of the individual or group is of course, to attain the highest possible level of utility, welfare or satisfactions (e.g., reach the highest possible indifference curve) through choice of an optimum combination of competing alternatives whether they are denoted by dollar income, material goods or mere subjective services. When the individual, family or society has given quantity of resources and resource services and consequently in producing money income as a good (product) or ownership as a good (product), a set of production possibilities such as those indicated by RL exist. The curve RL indicates all of the possible combinations of money income (or goods which can be purchased with money income) and ownership which can be obtained with the given resources. Within a range (the positive sloping portion of RL) we have shown ownership to be complementary with money income; through "production" or attainment of ownership, the farmer may also attain or produce greater money income. The two alternatives are complementary (1) where leasing systems are sufficiently inefficient to cause a greater profit to be forthcoming through ownership of factor services than through the renting of factors services, and (2) where the price of factor services purchased in the

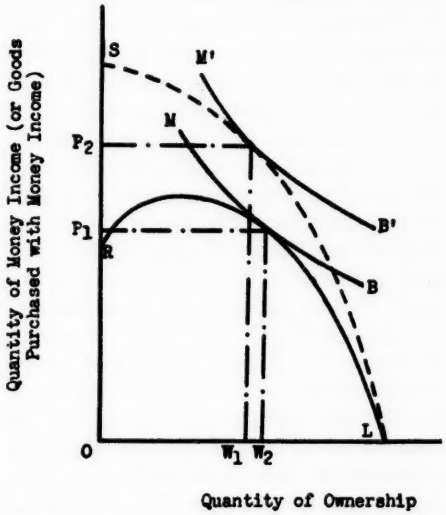

FIGURE I—Production Possibilities and individual or Group Values Relating to Money Income and Ownership with Optimal Choice to Maximize Welfare.

ownership market are sufficiently below the marginal productivity of the particular resources. While the possibilities of complementarity over all ranges of alternatives is not impossible, a more likely case is that complementarity eventually gives way to competition between alternatives. The negatively sloped portion of RL denotes competition between money income and ownership; more ownership can be attained, with given resources, only at the expense of money

income, etc.[2] Competition occurs particularly when the price of resources services is sufficiently lower than (a) the price of resource services through the ownership market, and (b) the marginal value productivity of the resources used in production.

An optimum choice can be made between money income as a good and ownership as a good only if we relate the indifference curve MB and the production possibility curve RL. Maximum utility or welfare is attained at the point of tangency; the rate of substitution of money income and ownership on consumption is equal to this same rate of substitution in production. Lower indifference curves intersect the production possibility curve and fail to denote maximum welfare while higher indifference curves (such as M'B') cannot be attained with resources and sets of alternatives denoted by RL. In the case illustrated, utility or living level is at a maximum when farm profits (goods purchased with profits) are OP_1 and ownership (or the direct utility derived from it) is extended to OW_2. Ownership is not extended to the limits possible and the operator may maximize his utility by owning machinery, livestock and other working capital while owning part and renting part of the real estate resources. The indifference curve will vary between individuals and, for some, ownership as a good may substitute for other goods at a rate high enough that investment in property will be pushed to the limit. Other operators may attach lesser values to ownership and consequently push it only to the apex of the opportunity curve (where complementarity is exhausted and beyond which ownership and profits become competitive.)[3] Ownership short of that necessary to exhaust complementarity is not consistent with choices which maximize welfare.

The figure above provides the relevant framework for analyzing ownership as an end standing at a level with other goods and services. The problem of choice is one of getting the optimum amount of ownership and other goods which gives rise to satisfaction. (Ownership is a non-competing means to other ends within the complementary range.) Ownership is not similarly an end for all people. Many choose the acquiring of resource services through renting and the consequent higher money incomes to the operation of small under-sized owned units and the consequent low standard of living. Some "well meaning" persons suggest farm ownership as a paramount end of individuals and therefore that society should go to unlimited extremes in settling more and more people on smaller and smaller units. "Ownership above all else" is advocated by many enthusiasts because they view ownership as an end which has priority over all other goods rather than relating it to the

[2] There have been many cases in history where income and ownership were complementary throughout all ranges of possibilities. Inflation in resource prices have given rise to this situation and other phenomena have also caused it. We do not analyze the details of this case since it is a modification of that mentioned in the text and the logic is obvious; ownership should be pushed to the limit of the production possibilities (e.g., the resources available) irregardless ot the slope of the indifference curve and the relative values which attach to the two alternatives. Other types of possibility curves could also be analyzed were it not for space limitations.

[3] Depending on the price paid for resource services through ownership or rental, the intertemporal production possibility curve may take several forms. Here we suppose that tenure security, the division of service inputs and product outputs and time considerations themselves cause ownership to be complementary with profits for some range. If the price of services obtained through the hiring or renting of resources is sufficiently low as compared to the price of those obtained through ownership, then the opportunity curve will have a negative slope throughout suggesting competition alone. If the price of services through ownership is sufficiently low and if the rental (or hiring scheme) distorts the intra-farm cost structure and iso-resource curve sufficiently, the production possibility curve may be complemetary through the main extent. Linear opportunity curves are also possible. These several variations are not presented since the reader can easily make the adaptations. These possibilities are explained in more detail in Earl O. Heady, *Economics of Agricultural Production and Resource Use* (New York: Prentice-Hall, 1952).

more general means-end framework. Some cite historic precedents to illustrate that individuals (or society) have (has) favored farm ownership in the past. It is not necessarily true that even past generations of our society viewed ownership as an end that should be selected over all others.

Farm Ownership Policy

Many of the discussions and even much of the policy which has revolved around farm ownership has not been set forth in a systematic fashion. It is for this reason that "reforms" and "recommendations" suppose that ownership should be extended at all costs. The important need is that these problems be analyzed in a relevant framework. First, some better notion should be obtained on the extent to which farm ownership currently serves as an ultimate end for farmers and other members of society. Next we need some notion of the extent to which this end, to the extent that it so serves, competes with other ends. Since the opportunities open to individuals and society are limited, some choice must be made. Ownership and farm numbers should be extended only as long as they do not conflict too greatly with other ends.

Alternative Means. Farm ownership, as a means to other ends, should be analyzed accordingly. First we need to consider the ends to which ownership is directed. Are there substitute means? Which means will allow the greatest total satisfactions to the farm family and society? It is because these questions have not been examined sufficiently that "ownership at all costs" has sometimes been emphasized and encouraged while important alternatives in improving leasing and tenure arrangements are passed by. Today there is little reason for drawing upon precedents of past centuries as a basis for pursuing ownership to the exclusion of leasing improvements. The danger that farmers of America need be or will be subjected to the feudal hierarchy of a king or reduced to the status of depressed tenants on the estate of William Penn or the Dutch patroons is no greater than the possibilities that laborers will be forced into sweatshops or a dictatorial social-industrial environment. While we cannot say that wide dispersion of ownership has had nothing to contribute to democracy, history has not proven that a population composed mainly of small farmers guarantees social and political stability while a population composed mainly of non-farm laborers must result in the opposite. The political and social instability of many rural nations in Eastern Europe and Asia indicate the dangers of driving farm numbers up and farm size down to a point where incomes are meager and political strife becomes rampant. In contrast the continued democracy of England and that of the Lowland and Scandinavian nations in Europe has illustrated that democracy is consistent with a large proportion of industrial workers and rented farms. A large number of low-income farms does not eliminate the threats of dictatorship or communism. The role of tenancy or ownership in facilitating democracy or dictatorship is still debatable.

With the increased price of the resources employed in agriculture, we need to examine the mechanisms which serve as substitutes for ownership as a means to more ultimate ends. Where ownership is a means to a more productive use of resources we are interested in whether the total of products and hence the level of living can be increased by substitute arrangements. In other words, as we examine figure 1, is it possible to alter imperfect leasing arrangements so that production possibilities are greater

and income and satisfactions can be increased? If these imperfections were removed, thus permitting resources on rented farms to be organized more effectively, would the opportunity curve be altered from RL to SL with accompanying opportunities for higher living levels (attainment of a higher indifference curve)? Where these changes can be made in leasing arrangements, ownership becomes less a complement to production and profit or it may substitute at a lower rate for money profit and other goods in the range of competition. Wherever changes of this nature can be made, a smaller amount of ownership is necessary for a maximization of individual and society welfare.

If the production possibilities could be lifted from RL to SL, the complementary relationship between ownership and agricultural production would be largely or entirely eliminated. Given the same individual or group values attaching to ownership and money returns as previously (as indicated by the fact that M'B' has the same slope as MB), a greater amount of market product and a smaller amount of ownership would then denote an optimal choice; as tangency of SL and M'B' indicates, OW_1 of ownership and OP_2 of money product now represents the most efficient investment or allocation of resources. As indicated by the fact that M'B' is higher in the plane than MB, the level of total satisfaction or welfare is higher when the production possibilities have been raised from RL to SL and the rate at which ownership substitutes for money income has been lessened.

The production possibilities can be raised from the nature of RL to the nature of SL through leasing improvements which allow more efficient production on rented farms and through a sufficient lowering of the price of resource services in the rented market relative to the price of the same services in the ownership market. When the production possibilities are raised through leasing improvements, gains are consistent with an increase in welfare for the total of society. The same reasoning applies to improvements in the factor markets which cause rental rates to be more nearly in line with the marginal value productivity of resources; the statement does not have universal application to society where a decrease in the price of rented services comes through an artificial lowering of rental rates to redistribute the total income in the favor of the tenant. While the alternatives perhaps are never completely competitive under most leasing situations, great opportunities exist for "lifting" the entire production possibility curve and "shortening" the range of complementarity through leasing improvements which include more efficient division of inputs and returns, compensation and tenures sufficiently long for planning purposes. More emphasis needs to be given these alternatives and the possibility of increasing tenant and total welfare through the process. This approach is more logical than the assumption implicit in many ownership discussions; namely, that production possibilities are fixed in the nature of RL and that such high values are placed on ownership *per se* as to cause the indifference curve to be nearly vertical and hence to favor "ownership at all costs."

While ownership *per se* likely stands at a high level in the minds of United States farm people, leasing improvements as a substitute for ownership (as a "means to an end") would undoubtedly lessen the pressure of farmers to become owners and to invest an important portion of their life to obtaining title to a tract of land. Some might never take the step to owner-

ship if leasing could be improved. A greater number would postpone the time of farm purchase and remain as renters as long as returns are greater through this system of purchasing resource services. Extension of the amount of renting (number of tenant farms as well as of the length of time over which the farmer operates as a tenant) would, in many instances, add to the total product forthcoming from given agricultural resources. Renting stands to increase efficiency where it allows a greater capital intensity and does not encourage extreme soil exploitation as in the case of the highly encumbered owner or the distressed mortgagor.

Where the span of the lease is so short or tenure uncertainty makes it impossible for the tenant to beautify the surrounding of the dwelling or to install electricity and running water, for example, alternative mechanisms to ownership should again be examined. Here ownership is not an end but a means to the more ultimate ends of acquiring access to consumption goods. Can compensation schemes be arranged whereby the tenant makes home improvements with a feeling of security? Can rental arrangements be devised whereby landlords invest in home amenities and receive a return on their capital in much the same manner as for any other investment? Some tenure specialists frown upon leasing systems which cause tenants to pay rent on improved dwellings or dwelling facilities; the practice is likened to usury or slavery. There is no reason why this should be so, however. The landlord who invests in an improved tenant house is no less a producer of consumption goods or services than the automobile firm or the local theatre which provides services which the farm family consumes. The public in general does not proclaim that the city capitalist should refrain from building apartment houses or other rental property from which laboring or other families can obtain living services at a price. In a market or enterprise economy, the production of services and the allocation of resources between different lines of production is guided by prices paid for the final services. Many farm landlords refrain from investing in home improvements because leasing customs do not provide for returns on the investment. Many tenants would prefer to rent a farm which includes better home improvements and undoubtedly would be willing to pay cash rent for these services.

While ownership is a means whereby the family invests in assets in order to provide retirement income, other alternatives also exist. One is the inclusion of farm operators under the Social Security Act. (Only recently have farm laborers been included.) Educational institutions also need to provide more information to farmers on outside investments. Historically, extension education has been narrowly focused on farm production and farm investment. Where savings are invested in farm property from a purely retirement standpoint, it is possible that investment in non-farm assets can provide as great or a greater flow of income during later periods. History is replete with examples where this has been true.

To the extent that ownership is a means to more general living certainty (a permanent location in a community of schools, friends, churches and other social organizations chosen by the family) means other than ownership are also present. Some of these are more drastic than those above, however, and may not be so nearly consistent with the value system of the American people. For example, the tenure system of British agriculture has allowed a secure life within communities. The environment existed, of course, because landed fami-

lies owned large areas over several generations. The frequent and recurrent change in ownership of rented farms in the United States has prevented this possibility. It might be made to exist, however, through public ownership of all land (nationalization of land resources), a measure unlikely compatible with values of the American society. Other alternatives are less drastic. In areas such as the Great Plains where the optimum farm size is great and where the cost of spreading schools, roads and electricity services over wide expanses is great, a farm-village system of agriculture is not only a trend but also has positive aspects not only from the standpoint of public costs and social contacts but also from the standpoint of "home security."

Land Reform as an Income Distribution Problem

Land reform and farm ownership problems are quite largely questions of income and wealth. They also have production economics aspects. Where land reform or small-farm ownership, a characteristic of European reform but not that of the Philippines or Japan, are voted in a democracy, the attempt of society is one of redistributing wealth and income.[4] In order that the citizenry can vote intelligently on such questions as these, information of the following types need to be furnished: first, analyses need to be made of the economies or diseconomies to scale in farming. The gains in welfare from income and wealth redistribution through tenure reform (creation of more but smaller farms) can then be compared with the losses in welfare resulting from a smaller total economic product. Farmers and society in general can then better decide the extent to which and the conditions under which they prefer income redistribution through tenure reform to income redistribution through other means. If the sacrifices in product are great, they may choose to alter the income distribution pattern through progressive taxation, extension of public health measures and home services while allowing the agricultural firm to approach the most efficient size. Where near-constant costs prevail in farming, the choice may be in a different direction.

Patterns of Production. While it is true that the division of large estates into many small units owned by peasants may reduce the total agricultural product where the newly created owners have insufficient capital, the reverse may also happen. In some countries much of the land on large estates was allowed to grow up to trees and brush or was relegated to hunting or other purposes contributing directly to the satisfactions of the owner and his family. Given the distribution of income and wealth which existed at the time, this use of resources could not be classed as inefficient. It represented inefficiency no more than the small portion of land on American farms allocated to lawns and gardens (both give rise to products which are not traded in the market but are consumed directly by the family). The economic problem involved was more nearly one of the optimum distribution of income and wealth. As taxation and other income and wealth transfer policies were put into

[4] Questions of farm ownership are sometimes posed as of a "political" rather than of an "economic" nature. However, questions of politics and economics are not often distinct but generally represent different facets of the same phenomena. The voting mechanism is a counterpart of the pricing mechanism. Individuals are able, given their personal incomes, to vote through the pricing mechanism for the patterns of production which they choose. Similarly they vote their choices of publicly-furnished services and goods through the ballot system. Both are "choice indicating" processes. Neither the pricing nor voting mechanisms need guarantee maximum economic welfare in a democracy. For a detailed explanation here see Kenneth Arrow, *Social Choice and Individual Action* (New York: John Wiley & Sons, 1951).

effect, it became possible or necessary that land and complementary factors of production be devoted to crop and livestock production. These are the commodities which denoted efficient resource use when income was redistributed and the larger populace had an opportunity to express its wishes on how resources should be allocated. Under the previous pattern of income distrubtion, it could not be said, however, that use of large estates for hunting purposes at the expense of potatoes and cereals represented inefficiency. The key to welfare maximization was the redistribution of income and the placing of choice indicators in the hands of more people in order that they could express their relative desires.

Land reform is not itself a permanent remedy in solution of those basic problems which revolve around the distribution of income in agriculture. This statement applies in different degrees both to wealthy industrial nations such as the United States and to impoverished agricultural countries such as those of Asia and Eastern Europe. At its very best, it provides a temporary and stop-gap remedy for income and population problems in those agricultural nations and regions where population is still increasing in Malthusian proportions. The real economic need in these countries is threefold and includes (1), the organization of resources to produce more income (consumption of good and services) (2) a distribution of production (income) in a manner consistent with welfare maximization and (3), a check on birth rates in order that the welfare gains or higher living levels from a greater production and a more equitable distribution of income (production) can be maintained. Land reform and a redistribution of farm ownership into a large number of small individual plots does not even guarantee an increase in total production. Taken alone, this form of income and wealth redistribution only provides a bit of slack in order that survival rates among agricultural people can increase and consumption per head can eventually be pushed back down to its pre-reform level. Land reform does not, in those highly Malthusian nations, eliminate the birth rate and population problems; it only provides a brief respite wherein numbers of consumers can again press upon the production available. Neither does an extreme number of small, owner-operated units guarantee maximum economic welfare of families in a wealthy nation where the very great productivity of resources is to be found not on small, under-sized farms but in non-farm alternatives; the values of the families themselves must be considered, of course.

Intra-Agriculture Investment

A second proposal sometimes accompanies the suggestion that "all families should own the farm which they operate." It is the notion that all children born to farm families should be given the opportunity to become farmers (and to become farm owners).[5] The proponents of this policy point with alarm to investment in farms by city dwellers. Also, they are highly concerned that a large number of farm boys

[5] Representative of this notion is the statement by Belshaw (in Ackerman and Harris, *Family Farm Policy*, p. 196) that the land tenure system should enable one with the necessary training and ability to engage in farming whether he has capital or not. The expression is also reflected in the great concern of agricultural economists and others that farm boys either (a) are unable to find a farm to rent, (b) must pay high rents and land values, or (c) must have a sizeable amount of capital to start farming. Some land tenure economists even propose that land prices be controlled or stabilized (see Harris and Ackerman, *Family Farm Policy*, p. 52), to facilitate farm ownership. The crux of the problem, of course, is one of making product and factor prices more effective in guiding resources into and out of agriculture as well as within agriculture. Even larger amounts of capital are required to become an entrepreneur in other industries. Stabilization of land prices would not eliminate the uncertainty problem of agriculture; instability must be attacked at its source which is variability of product prices.

cannot find units to rent except at high prices.

The notion that all boys born in agriculture should remain in the industry is, of course, quite absurd. As the important industry where births exceed deaths, all boys born in agriculture could become farmers and owners only as the number of farms grew indefinitely larger and the size of farms grew indefinitely smaller. Had this process taken place continually since the birth of the United States, farm units would now average small parcels. If this vein of thinking were applied to all industries, it would mean, on the one hand, that only the sons of dentists could enjoy the "right" to become dentists; only salesmen's sons would become salesmen and only professors' sons could become professors. On the other hand, it would mean that capital invested in the automobile industry could come only from persons currently owning automobile stock or from their sons; the "right" of investment in city rental property would be restricted to persons now engaged in this undertaking or to their children. In other words each industry would be set aside in a tight compartment. While industries would be allowed to trade products, they would not be allowed to transfer investment and resources across the "industrial borders." The final result would be a segmented producing organism wherein returns on resources would be extremely great in some sectors and extremely low in other sectors.

The basic need from the standpoint of fundamental problems in agriculture is of an opposite nature. Rather than hold increasing amounts of labor in agriculture where it must drudge out a meager living, we need to help farm children move out of distressed areas of agriculture into other areas and other industries where returns are greater and the level of living can be higher. At the very minimum farm children should be made acquainted with outside opportunities and provided with the education and skills which fit them for non-farm occupations. In a progressive and wealthy society, labor and human resources rank with the most important products produced by agriculture. The gain to be had from these resources, in excess of replacements needed in agriculture, is in producing the commodities and services of non-farm industries in order that the general standard of welfare can be raised even higher. With full knowledge of alternative employments, farm children could then better apply their own choice indicators (preference functions) in selecting agricultural as compared to other forms of production. To the extent that farming is preferred solely because of its security from major business cycles, the important task before society is one of eliminating this major economic imperfection rather than one of designing, as an imperfect substitute, a policy of "more and smaller farms." Rather than view the basic problem in the very narrow setting of "providing every boy born on a farm with a place in agriculture" we must view it from the broader angle as one of providing every person in agriculture (and other industries) with an opportunity to acquire education and skilled training in line with his inherent abilities, find employment where the productivity of these very basic human resource services are greatest and allow the individual choice of occupation and a suitable level of living.

Finally, it should be remembered that non-operating farm owners provide an important part of the investment in agriculture just as many persons outside of the telephone industry provide capital for the American Telephone and Telegraph Corporation. To eliminate this source of

capital (e.g., that furnished by city persons who own farms) would cause agriculture to suffer further hardships and would have the productivity consequences outlined elsewhere.

The values of populations change over time and the nature of "tenure possibilities" also go through an evolutionary process as land values change and new farming techniques arise. Tenure systems need to be flexible in allowing recognition of either type of change. The philosophy of Thomas Jefferson is sometimes cited as the precedent upon which United States tenure was and "should be" rooted. However, the tastes and and values of individuals or society change with time. Tenure systems should allow adaptation as each emerging generation formulates its own values. Land was a "free good" in the days of Jefferson; the population was predominantly rural and national policies directed at the farm population were necessarily those of the nation. Today the population makeup of the nation has shifted in the opposite direction and tenure policies should be directed as much at helping to fulfill the desires of the non-farm part of our society as in treating agriculture in an isolated, partial analysis. Selection of an alternative at one point in time does not dictate that the same alternative should be followed into the indefinite future. For example, society either knowingly or unwittingly voted parity prices to farmers as a means of increasing farm incomes in the 1930's. It has not, however, taken parity price as a "sacred" and "prescribed end" to be followed evermore. Increasingly, it has been recognized that income is not at all an end but only a means to other ends. Other forms of income subsidies are gradually emerging. These allow transfers of incomes but do not have the undesirable consequences of fixed or rigid parity schedules. Similarly, the fact that society a century and a half back voted that all farmers and farm-born people of the time should be given opportunity to be owners, need not be taken as an "all time societal directive" that current tenure systems must incorporate farm ownership systems for each boy born in agriculture. Changes in values and political systems the world over indicate that the tenure arrangement which is consistent with the particular society's concept of welfare maximization changes at the same time. The nationalization of industry and the possible nationalization of land ownership in England is an example of changes of these types. Certainly the steps taken were inconsistent with the "dictates" of the "free enterprise" England of two centuries back. Yet nationalization rather than individual ownership evidently coincides with the recent or current British society's concept of the proper tenure system in certain non-agricultural industries or at least was thought desirable at the time of the election. Similarly, the change in land values, the cost of farm capital and the willingness of outside investors to own agricultural resources should be recognized along with the value system of the population as the tenure system of America goes through its complete metamorphosis.

Natural Resources and Technological Change†

By JOSEPH L. FISHER*

THE commanding feature in the economic history of modern times has been the application of new and improved technologies in industry. Technological change has been relatively rapid and large-scale throughout our economic system—in manufacturing, trade, transportation, distribution, agriculture, and in the techniques of management and control. It has been especially true in the ways in which we use our natural resources—our land and water, our minerals and energy sources. More than this, technological change has greatly widened our whole concept of natural resources.

One purpose of this paper is to define and describe the role of natural resources in the process of technological change. This will involve the delineation of a concept of natural resources which may then be viewed as an integral part of the complex process of technological change. A second purpose will be to consider the problem of measuring the changing inputs of natural resources and resulting output of products associated with particular technological changes, or clusters of such changes. The crucial importance of costs, the availability of substitutes, and shifting demand patterns will be emphasized in their effects upon the magnitude, rate, and time at which technological improvements are actually applied. A third purpose will be to review the impact of technological change on natural resources in terms of the total economic and cultural environment.

I. The Concept of Natural Resources

Natural resources is an elusive term, principally because of resistance to framing the concept or definition in broad enough terms. It is not enough to say that natural resources are land, water, forests, and minerals—and let it go at that. What about the proverbial pint of water in the middle of the ocean or the tree growing in the most inaccessible part of the Amazon basin?

Flow, Relational, and Use Aspects. Actually there is no clear line; rather there is a border zone through which a resource passes as it moves from potentiality to actuality in the sense of having recognizable economic value. In this border zone can be found the near-ore of the mineralogist and the submarginal land of the agriculturist, neither of which can be utilized immediately and profitably at prevailing prices.

There are other border zones surrounding the concept of natural resources. One hinges on the word natural. It is common sense that a resource not yet touched by man or machine; but yet having value in the market, is a natural resource. How much labor and capital may be applied to such a natural resource before it graduates into the class of capital resource or consumer good? If coal in the seam is a natural resource, is coal in the tipple or stacked by the blast furnace still a natural resource?

It would appear that a natural resource is a growing thing which may move from a stage in which men are unaware of any economic potentialities through a stage in which men become increasingly aware of possible economic significance to a stage in which labor and capital are applied to it and it is

† A longer, first version of this paper was presented at the Conference on Quantitative Description of Technological Change, sponsored by the Social Science Research Council. and held April 6-8, 1951, at Princeton, New Jersey.

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able to command a price. The precise point at which one should cease calling the resource a natural resource and start calling it capital or something else is difficult to determine. The essential point is to understand the dynamic, growth-like character of natural resources.

Natural resources are not absolutes or end values. They are in the realm of means which may be used to help men in satisfying individual wants and attaining social objectives. This point is frequently overlooked by those who are overardent in their love of the good earth or in their enthusiasm for forests as forests. Natural resources, like all goods which enter the market place, take their meaning and significance from the ends they serve.

Natural resources are relative in other connections also. They exist as resources only in particular place, time and economic and cultural settings. The surf is not a recreational resource for Eskimos living on the Arctic Coast as it is for those American tourists who visit Hawaii. Iron ore was of no value during the Stone Age, nor was Diesel oil any use to the pony express.

Technology is a major feature of the existing American culture. It reaches into and touches everything. The most striking characteristic of our technology is its changeability. Natural resources have economic reality and significance only relative to the character and trend of technological change. They are as changeable as the technology which defines and surrounds them.

Most definitions of natural resources are based on an engineering, physical view. Natural resources are minerals, water, soils, and so on which are being or may some day be used by people. As more emphasis is placed on the use aspect, the definition takes on a form more significant to the economist.

Eric Zimmermann defines resources as "those aspects or phases of man's endowment and environment upon which people depend for aid and support"[1] He stresses the point that resources are means, not ends; that they vary with time, stage of civilization, wants, population, and other factors; and that the whole world must be taken into account in comprehending a particular resource in a particular place.

S. V. Ciriacy-Wantrup has developed a concept of resources not unlike that of Zimmerman's or the one characterized in this paper, which emphasizes the classification, interrelation, and use of resources.[2] He rightly points out that the customary distinction between exhaustible and nonexhaustible resources is more one of degree than kind, at least for the economist. Unit costs of and revenues from the resources, or the goods or services which the resource yields, determine when a resource will be used and when it will stop being used. Thus, we stop using a resource, theoretically, as soon as marginal revenue ascribable to the resource exceeds its marginal cost, regardless of whether the resource is physically exhausted or not.

Conservation. Before going further into the relationships between natural resources and technological change, it will be desirable to examine the matter of resources conservation—concerning which there seems to be much confusion.

Ideas about the conservation of natural resources are very much in the realm of social philosophy, policy, and action. Conservation is a rallying point, even a way of life, for those who believe in it

[1] Erich v. Zimmermann, "What We Mean by Resources" *Texas Looks Ahead*, Vol. I, *The Resources of Texas* (Austin Texas: University of Texas, 1944), p. 1.

[2] S. v. Ciriacy-Wantrup, "Taxation and the Conservation of Resources," *The Quarterly Journal of Economics*, November 1933, pp. 159-170.

most staunchly. For the extremist among the nature lovers, conservation is an absolute and its value to society and to individuals is beyond criticism. Despoilers of natural resources are the devils of this earth, whether they are ruthless business men, military leaders, or simply inconsiderate vacationers.

The goal of conservation has been stated as "the greatest good for the greatest number for the longest time."[3] Occasionally this has been interpreted to mean a complete locking up of reresources, usually by government, so that, as nearly as possible, the resources remain static and intact. An appeal is made to the so-called natural balance of humans, animals, plants, and the forces of nature. The tendency is to forget that the position of such balance itself shifts in response to technological change; changing distribution of humans, animals, and plants; and other factors.

At an opposite extreme are those who do not worry about the rapid depletion of forests, pure water, petroleum, and other natural resources. If they look very far ahead at all, they put their faith in science and technology to come to the rescue with new discoveries and applications. Scientists and engineers, this group believes, will keep us always a jump or two ahead of the grim consequences of resources that are about done for. By the time our oil and gas are gone, we shall be getting power from the atom, they say. By the time our lumber-yielding forests are completely denuded, pressed composition woods, glass, and light metals will be available abundantly and cheaply.

Many economists are in this latter group, mainly because a pre-disposition in favor of the free enterprise system and market price analysis for explaining economic behavior conditions them against both a long-range and a social point of view. For example, many conservation investments yield monetary benefits only so far off in the future and in such a diffused form that a discounting of the definitely foreseeable future benefits at the current interest rate on long-term bonds would indicate a zero or very low value for the investments, and they would not be made. The private economy with its many relatively quick yielding investment opportunities probably never will be able to handle anywhere near the volume of resources conservation investment that society requires for its own material advancement—indeed, for its own preservation. There is point to the statement that the United States grows by becoming poor so rapidly.

The major point at issue between these two extremes is basic. It is, at what rate may we utilize our natural resources, in many instances eating into capital stocks, without unduly endangering our economic and social future? To what extent ought we to rely upon technological advances, new sources of supply, substitutions, and shifts in individual demands and social objectives to make good or offset depletions in our natural resources? This is a question of intense practical, as well as theoretical, interest.

The principle of "wise use" has come to be a guiding one in conservation. In this country this principle—perhaps rule of thumb would be a better term—was first worked out fairly comprehensively in forest conservation. Wise use consisted of rebuilding the forests so that more trees might be harvested. Sustained yield at higher levels became the objective. Conservation was linked with utilization.

The wise-use principle has since been applied in the other resource areas and worked out in appropriate particulars.

[3] Gifford Pinchot, *Breaking New Ground* (New York: Harcourt-Brace, 1947), pp. 319-326.

In soil conservation wise use has come to mean rebuilding the productiveness of the soil by adoption of suitable farming practices, among which are liming and fertilizing, contour plowing and strip cropping, drainage, terracing, and rotation planting. In minerals, the so-called exhaustible resources, wise use now includes more efficient rate of extraction; elimination of waste in mining, transportation, processing, and utilization; intensive search for new deposits at home and abroad; substitution of low grade for higher grade ores; and substitution of plentiful for scarce materials.

One difficulty with the wise-use principle is that it seems to imply no general, single, and reasonably simple standard. It means quite different things to different people, and to the same people at different times and in different situations. It is different for different resources. It shares the difficulties of the "prudent man" theory, or notion, found in public utility economics.

Furthermore, it places resources in physical categories and fails to allow sufficiently for substitutes. Intensive efforts are being made to introduce more plentiful substitutes for scarcer mineral resources—coal for oil, shale oil for petroleum, low-grade iron ores for high-grade, synthetics for natural products, aluminum for copper, steel for aluminum, glass for tin cans, and so on. It appears that the use or service is a relatively fixed end, while the resources employed, within cost and technical limits, are substitutable. For instance, if the objective is to move railroad freight, whether the locomotive is driven by coal, Diesel oil, or electricity is of secondary importance. The main thing is to bring into effect promptly and smoothly those substitutions which are more economical and which appear to promote the national welfare and security, and which, of course, will perform the desired service.

Most discussions of conservation run in terms of physical amounts of resource. Ciriacy-Wantrup, among a few others, however, directs attention to changes in the rates of use of resources: "In 'conservation' the redistribution of rates of use is in the direction of the future; in "depletion,' in the direction of the present."[4] The goal of conservation, he says, is that distribution of rates of resource use which maximizes the present value of the flow of expected net revenues. If this is the goal in private economics, then in social economics it is to maximize the present value of expected net social revenues.

Actually, ours is a mixed private and public economy. In resources conservation activities public actions have long played an important role. People generally have realized that conservation programs are necessary to preserve and increase the flow of values which are largely too far off in the future or too socialized or intangible in character for the private market system to take account of adequately. This public or social aspect is so important that it places conservation firmly in the range of public policy.

Balanced Regional Development. Natural resources also have important regional or area aspects. Much has been written and said about balanced economic development, particularly balanced development of resources, both nationwide, and regionally. Despite its frequent use, the term "balanced development" seems to have no generally accepted and understood definition. There is no clear set of standards by which balance or lack of balance can be judged. Frequently, those who speak of regional economic balance refer to a national average as

[4] S. v. Ciriacy-Wantrup, *op. cit.*, p. 165; also *Resource Conservation Economics and Policies* (Berkeley and Los Angeles: University Press 1952).

the norm. Thus, it is often said, this region is under-industrialized or over-industrialized as compared to the nation, and is, therefore, not in balance. Obviously this standard will be misleading in a great many instances because a strict application of it would force a region to deny itself its own unique economic advantages. There would be a downward leveling with New England, for instance, trying to become more agricultural and less industrial, and with the Great Plains striving in the opposite direction.

Another concept of regional or national economic balance runs in terms of finding particular bottlenecks to economic development, and then overcoming them. Every bottleneck overcome is a step toward better balance. Thus, a bottleneck in the Southeast may be lack of capital for new industries or lack of adequate soil conservation. In the Mountain West it might be lack of water or high freight rates. New England might find the lack of a large iron and steel plant or lack of low cost electric power to be among its principal bottlenecks.

In a general way, balanced development seems to imply a smoothness in rate of growth, presumably and principally of income, per capita income, employment, and resource utilization. The corrective for a tendency toward unevenness of growth—that is, lack of balance—usually is an investment program of some sort, such as more electric power, the halting of natural resource deterioration, a new industry, an improvement in transportation facilities, or possibly a vocational training or retraining program. Occasionally the the correction factor is the in or out-migration of people, a national crisis such as war, or large-scale defense preparations, or something else. Particularly with the relevance to resource development, the idea of balance usually implies sustainability over the long run. This objective may require a slower rate of growth in the immediate future, and it may place other limitations on certain types of development which result in heavy demands on natural resources.

A kind of economic balance probably can be achieved at unsatisfactory as well as satisfactory levels of income, employment, or natural resource utilization. This kind of balance frequently characterizes so-called underdeveloped areas but, of course, is not the kind desired by those concerned with economic development.

II. Natural Resources and Technological Change: Interrelationships and Measurements

The Two-Way Interaction. The most dynamic force in the continual process of emerging natural resources is technological change. Conversely technological change is heavily conditioned by the concepts and potentialities of resources. Technical developments in manufacturing, agriculture, and transportation alter our very awareness of what are resources as well as the prices which they command. There are many dramatic instances of this interrelationship. A large tract of the New Mexico desert was valueless in the economic sense until a few years ago when such a tract was needed for a guided missile range.

The enormous deposits of oil shale in western Colorado, although known for a long time, only recently have begun to appear valuable. This has been due to improvements in mining the hard shale and in methods of converting it into usable oil products. In time, such developments will probably lead to major economic changes. They will increase sharply the value of water in this part of the state, where already it is scarce, be-

cause of the requirement for large amounts of water in the processing of the shale. Assuming large scale development takes place, whole new cities will have to be built leading to complex new patterns of land use. Through the purchase of mining and processing supplies and equipment, through further purchases of all sorts which will be made by those who come to live in the area, through shipment and sale of oil products, and through a myriad of other channels, the effects if this particular technical change would reach out in all directions to the rest of Colorado, the other states, and ultimately to the continents of the world. In fact, neither the technological change nor the character of the natural resource would be anything like the same if these geographically more remote effects were not a part of the picture. A resource, therefore, can be visualized accurately only by taking a national and worldwide outlook.

The change need not be one associated with technology in the narrow sense of physical science and engineering. The change may occur in management, finance, marketing, labor relations with equally significant effects. The development, for good or bad, of all-pervading, high pressure advertising in this country, based in part upon technological advances in radio, television, and printing and publishing, has contributed to natural resource changes. One thinks of whiskey, advertised so colorfully, and the water supply problems of Louisville, Kentucky, or Peoria, Illinois. One thinks of cigarettes and the effects of constant tobacco cropping on North Carolina soil.

The changing concepts and possibilities of our natural resources also guide, expand, and sometimes limit the process of technological change. Examples are numerous. The research program designed to improve and lower the cost of producing liquid fuels synthetically from coal, including low-grade coal, is being pursued within the framework of knowledge we already have regarding the chemistry of hydrocarbons, the laboratory and industrial possibilities for converting coal into liquid fuels, the prospective increased demand for these fuels, and the trends of reserves and new discoveries of petroleum.

An example on an even larger scale is seen in recent developments in atomic energy. For a number of decades physicists have known about the enormous energy locked up inside the atom. Theory had established a formula for calulating the amount. It was known also that uranium ore might be made to yield sufficient quantities of radioactive substances. World War II provided the intense motivation necessary for translating theory and limited knowledge about uranium into the atomic bomb. A framework of knowledge about radioactive elements, metallurgy, sources of uranium ore, development of very large blocks of low cost electric power, plus the keenest awareness of need, had to be in existence before the final technological development of the bomb could take place. Following in the wake of the main achievement will come waves of technological change which have only begun. The rapidly increasing use of radioactive and stable isotopes for research in medicine, industry, and agriculture has already yielded important results. The recently announced experimental programs of several private companies in investigating technical and economic problems of joint production of plutonium and electric power are an indication of possible changes yet to come.

The point then, is that natural resources and technological change inter-

act. They mutually determine one another, as each and both are guided by emerging and changing patterns of individual wants and social objectives.

Types of Innovations. From the natural resources point of view technological changes may be divided into those which are resource-using and those which are resource-saving.[5] In the first instance, a resource-using technological change, or innovation, is simply one which results in an increase of the physical amount of the natural resource used per unit of output. A resource-saving innovation is one which results in a reduction of the amount of the resource used per unit of output.

In terms of the absolute amounts, a resource-saving innovation thus defined may well result ultimately in more of the resource being used, especially if the effects are considered after time has elapsed. A resource-saving innovation, for example, may lead to a reduction in product unit cost, and ultimately, perhaps because of a relatively high price elasticity of demand, to a large increase in the total number of product units produced and sold, and ultimately to an increase in the absolute amount of the resource used.

A resource-using change might be expected to set in motion forces tending to raise the price of a unit of the resource as more units are used. This situation carries with it a motivation for enterprisers to seek other innovations which will reduce the intensity of the use of the particular resource in question relative to other factors of production.

There are many other ramifications of resource-using and resource-saving innovations. For instance, a resource-using innovation may so hasten the search for substitutes as to displace eventually certain uses of the resources entirely. A resource-saving innovation, on the other hand, may so prolong the life of the resource as to disengage completely the attention which might have been given to substitutes. That is to say, one innovation sets the stage and gives direction to the follow-up search for new innovations.

It makes a difference whether attention is confined to the immediate process surrounding the innovation, or whether broader industry-wide and longer-term effects are considered. An innovation in steelmaking at first may mean more steel for the construction of new furnaces and, if this is counted, the innovation might be called resource-using. Later, after completion of the furnaces, it might become resource-saving.

Guides for Research. The general policy goal should be to encourage technological change, and types of innovations which will be resource-saving, with greatest emphasis being placed on those resources, reserves of which appear most limited and substitutes for which appear most difficult to find. This points toward the more intensive development of potentially more abundant substitutes such as shale oil for petroleum, aluminum for copper, plastics for wood, and hydroelectric power for oil and gas-produced power.

It should also be recognized that, in general, it is in the public interest that research policy be directed especially toward those products for which income, price, and time elasticities of demand are thought to be high.[6] This, of course, would tend to result in greater pressure on any natural resources utilized than would be the case if research were con-

[5] For other classifications see: Yale Brozen, *Social Implications of Technological Change* (A Research Planning Report, preliminary draft mimeographed, Social Science Research Council) 1949.

[6] Harold J. Barnett, "Criteria for Allocation of Research and Development Funds," United States Department of the Interior, Program Staff, July 29, 1949. (*typescript*)

centrated on products with low demand elasticity. Also, research policy should focus on products whose relative prices are rising, and especially on those production factors the costs of which are increasing. Among these are many natural resources such as fuel and minerals.

Input-Output Measurements. The next task is to explore some of the problems of measuring inputs of natural resources associated with technological changes in relation to specific innovations and in terms of the whole national product. Lack of homogeneity, which characterizes many natural resources, makes such measurements difficult.

One way of summarizing the effects of a technological innovation on a natural resource would be to note the change in the ratio of the input of the resource to the output of the product both before and after the innovation. One danger here is that changes in the ratio will be due partly to other forces besides the innovation, and therefore will be misinterpreted. This method, consequently, would have to be used circumspectly.

A starting point is to identify the particular innovation and wave of technological change to be considered. This might be the machine cotton picker, a process for iron ore beneficiation, a gas turbine, or an airplane jet engine. It might be what many would call a nontechnical innovation, such as a federal forest practices regulatory law, a new method of financing river development projects, or a new soil conservation educational technique, any one of which might have a considerable effect on the use of the relevant natural resource.

Next the input of the natural resource in physical terms should be measured at the most convenient point immediately preceding the point at which the innovation is applied. The input might be in acres of land, acre-feet of water, tons of ore, or cubic feet of wood.

Next the output of product in physical terms should be measured at the most convenient point immediately following the point at which the innovation is applied. This might be in pounds of cotton, tons of hay, tons of ingots, or amount of pressed wood.

Finally, ratios should be calculated over a period of time extending from before the innovation was first applied to after the the innovation wave has worked itself out—ratios relating the resource input to the product output in physical terms. Such ratios might be in acres of land per bale of cotton or tons of iron ore per ton of steel ingots. It might well happen that an innovation which at first appears to be significant chiefly for one resource input would turn out in the end to have a greater effect on some other resource input which, after the innovation, would be required in much greater or less amount.

The physical input-output ratio could be translated into value terms by taking the dollar cost of the amount of input factor associated with a dollar's worth of the product. Both types of ratios should be taken into account. With the prevalence of factor and product market imperfections and materials priorities, allocations, and price controls, particular attention should be given to physical ratios. This is especially true in a high-level defense economy in which, to a degree, costs can be waived, if that is necessary, to obtain needed amounts of metals, power, food, and other necessary items.

The interindustry relations studies, frequently referred to as the input-output studies, are a major source of information on both statistics and techniques. These and related studies should furnish useful evidence bearing upon the relationships

between natural resources and technological change. Of course, what would help most for this purpose would be the introduction of the time element into the equations, or at least a comparison of input-output coefficients for each of several years.

Certain more aggregative input-output relationships might also be helpful in revealing the general effects of technological change on natural resources. There is no single, usable unit of measurement for all natural resource inputs except the dollar. Theoretically, it would be possible to add up the natural resource factor costs and relate them to the total value of the output of the national economy. Disregarding such problems as defining natural resources, and after eliminating the effects of price change, a time series of such ratios might give some indication of the change in relative economic importance of natural resources in the economy. A wave of resource-saving innovations might be expected to be reflected in a decrease in the ratio.

The aggregative approach perhaps would be more useful when applied not to all natural resource inputs, but rather to the inputs of clusters of resources which can be measured in the same physical units. Thus, one might try to determine over a period of time the production of agricultural products in tons per acre of land used for agriculture, or per ton of fertilizer, or per unit of agricultural manpower. Or, the input of coal or other fuels required to produce so many British Thermal Units of energy might be calculated.[7] Such measures abound in theoretical and statistical difficulties. But they might serve to give at least a rough indication of technological changes as they affect the inputs of and outputs resulting from certain natural resources.

Another type of measure would be obtained by relating for a period of years the gross national product to such aggregates as the the number of BTUs or kilowatt hours produced, or the amount of mineral or agricultural production. Such measures are analagous to the commonly used aggregative measure of labor productivity in terms of GNP per man hour of employment.[8] In fact, energy may be more significant than manpower in the expansion of GNP. In any event, increases in GNP are due always to the variety of interacting input factors, including management and enterprise, and it is misleading to ascribe GNP increases to inputs of labor, energy, or any other single factor complex. Careful interpretation of these kinds of ratios, made in the light of technological changes under way, should facilitate judgments as to relationships between technological change and natural resources. Because of the increasing importance of services and values added in the later stages of production, the inputs of agricultural products, forest products, fuels, and other major resource clusters have been increasing at a slower rate than GNP over recent decades for which figures are available.

The gross national product might also be related over a period of years to the associated annual dollar amounts of investment in mining, agriculture, forests, or water development. Because of varying time lags between a resource investment and its impact on production, the

[7] See Harold J. Barnett, *Energy Supplies and Uses, 1939, 1947, 1965*, (Washington, D. C.: United States Bureau of Mines) Information Circular 7582, October 1950.

[8] For a critical discussion, see George J. Stigler, *Trends in Output and Employment* (New York: National Bureau of Economic Research, 1947), especially pp. 49-53. Also Hiram S. Davis, *The Industrial Study of Economic Progress* (Philadelphia: University of Pennsylvania Press, 1947), Ch. IV and elsewhere. The Council of Economic Advisers makes use of this productivity measure in its semi-annual *Economic Review*.

meaning of such relationships would be obscure. The relationship between the value of production in mining or agriculture and the associated dollar value of investment would probably be more revealing.

In the economic world it is seldom possible to isolate and control innovations sufficiently to determine their quantitative effects exactly. If this is the case in appraising a single technological change made by one firm, it is even more the case when it comes to gauging the broader economic effects of an innovation on an industry, or on the whole economy. However, without quantitative measures, or at least indications, of the economic as well as physical effects of technological change on natural resources, we would remain largely in the dark regarding the meaning of the change and we would not get much closer to controlling it.

III. The Importance of Costs and Benefits

Before a natural resource moves from the stage of potentiality to that of actual use, it is usually necessary that its cost be lowered to within that range which makes it competitive with alternative resources. The impact of technological change on natural resources, in fact, comes as the costs of application approach competitive levels. Therefore, the immediate goal of much research and most engineering experimentation relating to natural resources is to bring down costs, both of the resources as factors and of the products for which resources are used.

The alternative resources may be so similar as to be interchangeable. More frequently, however, they are not perfectly substitutable. This means, for instance, that a resource superior in quality will tend to be substituted for an inferior one before the price of the superior resource has been lowered to that of the inferior one.

This key role of the search for minimum costs has been illustrated time and time again. In the case of oil from shale, the objective has been to lower costs of mining and production. Recent reports indicate that motor gasoline and residual fuel oil can now be produced at Rifle, Colorado, or vicinity, from shale at a cost approaching that of similar products produced from petroleum. Realistic cost comparisons are difficult to make since assumptions have to be made as to such matters as size of plant, rate of depreciation on plant and equipment, and proportion among the several products turned out. There remains the problem of transporting the shale oil to markets sufficiently large to take the oil produced in an economically sized operation. The particular phases of the total mining and producing operations for which further cost-reducing improvements are needed are usually fairly well known. Efforts will be concentrated at these points.

Another example, one which has not yet proved feasible, is the production of electric power from the movement of the tides. Studies made of the United States Passamaquoddy tidal power project, located in eastern Maine, indicate that the kilowatt-hour cost of power produced there, plus the cost of transmission to large enough markets, would exceed by a considerable amount the cost of presently available and potential hydroelectric power from Maine rivers. To the extent that cost and marketing considerations govern, electric power developed from this source will have to wait for cost reductions, enlargement of the project scope, or other changes which will give this power competitive status.

Evaluation of Public Costs and Benefits. So long as the natural resource and its processing are mainly in private ownership, then costs or prices in the market sense are controlling, regardless of market

imperfections. However, basic natural resources such as land, water, or forests are so clearly and overwhelmingly a matter of broadest public interest that the people, acting through their governments, have never allowed the use of essential resources to be controlled entirely by private persons and groups. Public welfare has always required that ordinary considerations of cost in the commercial, market place sense be supplemented by public decisions in matters relating to basic natural resources.

Considerations of this kind have resulted in more recent years, for example, in the several soil conservation programs of the federal government in which farmers have received fertilizer, technical services, and money payments. The rationale for this is that many farmers, on a cost-price-profit calculation, will be unable to conserve and improve their land to the extent that the general welfare, now and particularly in the more distant future, requires. Large federal investments, only partially repaid by users, have been and are being made in land reclamation projects in the arid West. These subsidies have been justified as desirable as a means for increasing the production of agricultural crops, for developing areas and regions, and for augmenting regional and national security.

It does not appear feasible to make dollar estimates of all the social costs or social benefits of resources conservation and development investments, particularly those more distinctly public in character. Recently an attempt has been made to go quite far in this direction but certain important costs and benefits were found to be so intangible, remote, or generalized that precise monetary calculation was deemed impossible.[9]

[9] *Proposed Practices for Economic Analysis of River Basin Projects*, Report to the Federal Interagency River Basin Committee, prepared by the Sub-Committee on Benefits and Costs (Washington: Government Printing Office, 1950), pp. 26-28.

Benefits and costs associated with the protection of human life, and with cultural and scenic advantages, and the like should be taken into account in the process by which natural resources projects and programs are formulated and later evaluated. These values have to be considered primarily in non-monetary terms, and then allowed to influence decisions. Since these are in part matters of public interest, government has the responsibility for insuring they are given consideration and, if necessary, paid for out of public funds.

The evaluation process is akin to government budgeting. For various categories of resources investments, degrees of reliance upon different types of evidence should be established. Thus, for a single-purpose hydroelectric power project, which produces marketable power, monetary estimates of benefits and costs, based upon market prices, may constitute the principal evidence upon which decisions should be made. On the other hand, for a multiple-purpose project involving irrigation, watershed management, recreation, flood control, and other values—not all of which can be reduced to a monetary calculus—monetary estimates of benefits and costs should constitute only a part, in certain cases a small part, of the evidence which is brought to bear upon the decisions. The final decisions are reflected in definite monetary expenditures, but they are arrived at by a more comprehensive and complex process of analysis and judgment. Sometimes it is helpful to distinguish between the economic effects (benefits and costs) of the process of constructing project in terms of employment and income, and the effects of the project after it is in operation.

The evaluation of a resources expenditure has two significant phases. First is the benefit and cost or investment return,

evaluation which should precede the expenditure and which is the basis for deciding whether to spend the money or not. Second is the evaluation which should follow the completion of the expenditure. It is a kind of post-audit to discover whether the expenditure has led to the benefits expected. Such post-audits should be made periodically over the useful life of various resources projects and programs, since what would appear to be benefits or costs one year after a project has been in operation may change greatly after five, ten, or twenty years have passed.[10] The economic historian should be called upon to appraise resources projects and programs after the projects and programs have been in operation for a period of time to determine where they have over- or under-achieved the results projected for at the time they were formulated and started. It should then be his duty to advise those who must make decisions on the merits of future projects. For example, post-evaluations of the Hoover Dam and other large Colorado River multiple-purpose projects which have been in operation for some time should be helpful in determining the kinds and amounts of benefits and costs which would probably result from the proposed Bridge Canyon project.

In any event, in making these and other similar decisions the larger aspects of social benefits and costs have to be analyzed to insure that market considerations will be modified when the public welfare demands it. Changing views as to welfare requirements and public goals associated with the use of natural resources, therefore, must be entered into the reckoning of forces shaping technological change.

[10] See the President's Water Resources Policy Commission report, *A Water Policy for the American People* (Washington: Government Printing Office, 1949), Vol. I, Appendix 4. Compare *ex ante* and *ex post* treatment of evaluation in Ciriacy-Wantrup, Resources Conservation Economics and Policies, pp. 30-31, and *passim*.

IV. The Total Economic and Cultural Environment and the Impact of Technological Change on Natural Resources

An understanding of the inter-relations between natural resources and technological change involves also taking into account the total cultural environment. Resources and technology are a part of the whole culture and are perceived only within the changing patterns of folkways, mores, social institutions, and other elements of the culture. A few culture factors important to a grasp of the impact of technologcal change on natural resources may be pointed out.

Public Attitudes and Technological Insights. The prevailing view that people have regarding the importance of resources conservation is significant as a factor conditioning technological change and natural resources. In a society which cares little about conservation, innovations which lead to resource waste will be encouraged so long as their application yields sufficiently high and immediate returns. In general, in this country we have not adopted adequate long-term conservation practices unless it seemed they could be made to pay out in the relatively short-term market sense. Only through public action, or far-sighted corporate or individual action, has it proved feasible to take a viewpoint long enough in range to guarantee conservation and sustained yield from our soil, water, range, forests, fish, and wildlife.

Slowly over time man's private scales of time preference for present over future satisfactions may shift so that more adequate attention will be given to resource conservation. This would have to come as part of a profound change in our evaluation of the welfare of our children and

their children as compared to our own welfare. Such a change would have to be solidly enforced in custom, habit, law, and morality, and could be promoted by educational effort. It would reject current practices and technical possibilities which transgressed the generally accepted principles of resources conservation.

A related aspect of the total culture which is of critical and determining importance to the impact of technological change on natural resources are those factors which encourage and develop man's perception of the inherent potentialities of technology and resources, and his theoretical and practical insight as to how the potentialities may be realized. Certain cultures are more hospitable than others to this kind of perception and insight. Among the factors which probably promote such a receptivity is a high level of general education, but more particularly an emphasis on scientific and technical education. A careful selection of scientifically gifted youth, for advanced training with subsidies for their schooling, if that is necessary, also contributes to such a condition. A culture in which freedom for individual research is blended with recognition of the advantages of cooperative or group research, and in which material progress is held in high esteem is also a significant factor. Government, private industry, and universities among them sponsor and direct nearly all the research done in this country, and consequently have it within their power and field of responsibility to suggest policies and programs which will facilitate technological advance in the use and conservation of resources.

Two other aspects of the total economic and cultural environment may be mentioned here as significant for changes in resources technology. One is the degree to which venturesomeness is encouraged, by industry, by government, and by the whole way of life of the people. The other is the degree to which sufficiently large amounts of capital funds can be amassed for increasingly costly programs of research and development.[11]

Legal Factors. The legal and political framework, of course, along with the economic and social, can foster, retard, or be neutral toward resources innovations. Patent law is an obvious example, as is public land law, water law, and mining law. Throughout our history, laws governing the disposal of the public domain have conditioned both the rate and nature of private agricultural and other types of land development.

Legal changes now under consideration would alter resource technology. For example, the United States Forest Service has long been advocating a federal law to encourage and ultimately require states to enforce specified cutting and other forest practices on privately-owned land. The aim is to build up forest resources over a period of years to a general position of high level and sustained yield. Such an enactment, assuming adequate enforcement, could lead to whole new patterns of forest technology and economics in many places. These changes would have important effects in related areas such as agriculture, grazing, and watershed protection against floods and soil erosion. The more favorable the political atmosphere for such legislation, and the more readily the forest owners and operators accept and cooperate with such a program, the more rapidly the induced technological changes would work themselves out.

War and Crises. Another aspect of our culture which is of critical importance

[11] Compare Stephen Raushenbush, "Economic Considerations in Conservation and Development," Proceedings of the United Nations Scientific Conference on the Conservation and Utilization of Resources (Lake Success, N. Y.: United Nations, Dept. of Economic Affairs, 1950), Vol. I, pp. 207-209.

now and which greatly affects the relationship between technological change and natural resources is high level defense activities, war, and related crises. Such crises are spurs to many kinds of technological change and act with tremendous suddenness and force. Expansions in the atomic energy program amounting to several billion dollars coming on the heels of the outbreak of war in Korea, provide a dramatic illustration. The magnitude and character of the changes which this expenditure will set in motion are unknown at this time, but may well prove to be earth-shaking, both figuratively and literally. The requirement for at least one natural resource, hydroelectric power, will be tremendous in certain of the areas chosen for new or expanded facilities.

Other crises due to natural catastrophes exert great influence on resource innovations. For example, the great 1924 floods in the Mississippi River system led rather directly to the formulation of a vast and integrated plan for flood control which was a major step forward in our whole approach to the problem.

Summary

The exploration of the relationships between natural resources and technological change is difficult, both conceptually and quantitiatively. Conceptually it is difficult because of the fuzziness surrounding such terms as natural resource, technological change, resources conservation, and balanced resources development. Quantitatively it is difficult because of the relative scarcity of relevant input and output data, the problem of isolating particular individual innovations or clusters of innovations, and the problem of trying to make some use of dollar values as well as physical amounts.

The concept of natural resources most helpful to the economist appears to be one which focuses first upon the broad uses to which resources are put. Thus, one large cluster of resources yields energy, another food, another fiber. Within these clusters numerous resource substitutions are possible, and the proportion of use among the particular resources is continually changing, depending upon changing costs and prices. Advances in chemistry and other sciences and technologies now make possible certain resource substitutions between clusters. Thus, textile fabric can be made from coal, alcohol fuel from grains, and so on.

The economic objective should be to maximize the flow of utilities from natural resources, both directly and as these resources may be embodied in manufactured products. The length of time brought under consideration should be sufficiently great to ensure that the broad utilities derived from basic natural resource clusters will be maintained and, to the degree possible, increased. In many instances this means public action, since returns are too distant to justify private investment. Regarding the exhaustible type of resources, particularly, this objective implies a direction of substitution toward renewable resources or at least toward more plentiful exhaustible resources.

Natural resources are relative in several dimensions, including space, time, and culture. What is a resource in one time, place, and type of culture is not necessarily a resource in another. The full scope of a particular resource cannot be seen except in world-wide terms.

Natural resources and technological changes limit and define each other. One can hardly be conceived without the other. Perhaps the most useful classification of resources in terms of the effects of technological changes upon them is that between resource-using and resource-

saving, in both the physical and the economic sense.

The task of measuring and comparing natural resource inputs and related product outputs over a period of time will give some clues as to the quantitative nature of specific technological changes. The broader effects are indicated by ratios which relate natural resources used to national output. The more complex the industrial structure of the country becomes and the more important economic service activities become, the less significant natural resources will appear to be. This, however, is misleading because natural resources, as much as ever, are at the foundation of the whole structure, and this has been particularly characteristic during the recent period of production emergency.

In considering changes in patterns of resource use the focus of attention should be on costs, but not on private business costs alone. A large volume of natural resource investments are made directly, or underwritten in some way, by government on the basis of judgments as to social costs and benefits.

Certain major factors arising primarily outside the economic realm have large and frequently determining effects upon natural resources. Foremost among these at present are war and the threat of war as they react on the economy.

If this paper has succeeded in raising important issues regarding natural resources and technological change, and been suggestive of ways of approaching satisfactory concepts and measuring devices, it will have fulfilled its purpose. Neither the concepts nor the measurements discussed really button down the matter. The subject is so large and many-sided that a complete understanding of it is more than we can expect.

Forecasting the Population of Small Areas†

By JACOB S. SIEGEL*

Introduction

A Dilemma. It is now generally held by the more prominent and learned members of the fraternity of professional demographers that, with present knowledge and techniques, it is not possible to forecast the population of small geographic areas accurately.[1] Irene B. Taeuber wrote as follows in *Population Index* as recently as January 1949:[2]

". . . . practical political, economic, and social needs for estimates of the probable size and composition of the future populations of regions, states, and cities have forced students to make estimates in general disregard of the adequacy of data available for such estimation . . . Regularities in the geographical paths of migration have been shown to exist . . . . The utilization of this knowledge for estimating the future, however, requires estimates of magnitude. Such estimation is as yet impossible."

Moreover, empirical evidence as to the relative accuracy of various methods is not at hand which points the way to the use of a particular method or methods. The few tests conducted so far either were not designed to answer this question or are inconclusive with respect to it. Many demographers have preferred the elaborate "cohort-survival" method on *a priori* or logical grounds but, for all we now know, this may represent an unfortunate waste of time and effort where simpler methods would be just as accurate. (This method essentially involves carrying forward the latest current population by *age* to future dates with separate allowance for the components of population change, namely, births, deaths, and migration.) It seems reasonable to hope, however, that in time demographic research will develop more specific guides for forecasting the population of small areas than now exist and it may be maintained that even now the approach of demographic science can improve upon mere guesses.

But the dilemma implied in Dr. Taeuber's statement still faces us. The demand and need for accurate forecasts are considerable since they are essential for many purposes. This need was stressed by several speakers engaged in planning work at the regional and local level, at a panel session on "Population Projections for States and Local Areas" at the 1952 annual meeting of the Population Association of America.[3] Undoubtedly, therefore, workers will go on developing forecasts in spite of the discouraging views of demographers, which perhaps fortunately some of them have never heard. It is notable too that many demographers have themselves published small area forecasts.

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[1] For the purposes of this paper, I shall confine myself to forecasts of total population and shall consider a "small area" a specific geographic subdivision of the country, such as a region, state, subregion, metropolitan area or district, county, or city. It should be noted that all these areas present essentially similar problems of estimation and that from a global or even national perspective all are relatively circumscribed areas.

The reader may note my preference for the term "forecast" in contrast to the term "projection" when a figure for the true or actual size of the future population of an area is referred to, as is the case here. It is recognized that under some circumstances the true or actual population is not specifically sought, as when one develops several series of figures in order to evaluate the effect of some factor on population growth.

[2] Irene B. Taeuber, "Literature on Future Populations, 1943-1948," *Population Index*, January 1949, p. 10.

[3] Vincent H. Whitney (rapporteur), "Population Projections for States and Local Areas," *Population Index*, July 1952, pp. 178-180.

Scope of This Analysis. It seems pertinent, in view of the dilemma stated, to consider in some detail the present status of both the practical and theoretical work in forecasting small area population. I shall discuss in particular the subjects of reliability and the available aids to forecasters, but I shall also consider such matters as the characteristics of producers of forecasts, the characteristics of the forecasts produced, and the development of forecasting.

I should have liked to be able to present at this time a comprehensive quantitative summary of the work which has been done in the field of small area forecasting based on an intensive examination and analysis of all pertinent materials. It would be a virtually impossible task to make a study of this type. First, much of the work on small area forecasts is probably not published, but is developed solely for use within a particular organization. This is undoubtedly true of the work of private business firms in this field generally, which have no responsibility for making the figures available publicly and which, in fact, because of competition in an industry would choose to restrict them. Another problem is the difficulty of securing all, or nearly all, published reports presenting forecasts. Some are not available because they have been distributed on a limited basis or are out of print; others include forecasts as a quite incidental feature and hence may not always be recognizable as pertinent to a study on forecasts. Finally, it would be a task beyond the limited resources at hand to secure and analyze in a reasonable time all the reports pertinent to such a study.

For the present purpose, therefore, it was necessary to conduct a much more restricted study, namely, the examination and analysis of the readily available, recently published reports presenting forecasts and, in particular, those which appeared in 1930 or later, were readily obtainable in the Census Bureau or the Library of Congress, and which gave some indication of having a formal discussion of future population. It is quite probable that some reports which should have been included have been omitted since we found pertinent bibliographic listings for several reports which could not be located. Early reports are probably more under-represented in this study than recent ones. It is believed, however, that all or nearly all of the more important reports have been included. In all, 90 separate reports were finally included in the study.[4] Earlier this year Shryock made a briefer study of reports presenting forecasts, limiting himself to a description of some of the more general characteristics of the reports.[5]

Some Characteristics of Forecasters and Forecasts

The Producers of Forecasts. Thirty-seven out of the 90 reports included in the present study were published by an agency of a city or county government, usually the city or county planning commission [1-37], 10 by a state agency [38-47], 3 by a regional agency [48-50], 22 by a federal agency [51-72], 11 by an educational or research organization [73-83], and 7 by a business firm, trade association, or other special interest group [84-90]. The individuals who actually developed the forecasts shown in these reports vary from sociologists, demographers, economists, and city planning analysts to engineers, journalists, and just plain local boosters.

[4] A complete list of the reports included in the study is given in the Appendix. Items in this list are referred to in the text by bracketed numbers.

[5] Henry S. Shryock, Jr., "Population Projections for States and Local Areas" (summary), *Population Index*, July 1952, p. 178.

The results of the study give a striking indication of the extent to which population forecasts are used in local and regional planning. Government-sponsored reports containing forecasts are generally prepared in connection with public planning work. At the federal level, there are, for example, the Power Market Surveys of the Federal Power Commission [52-65] and the Economic Base Studies of the United States Office of Industry and Commerce [71-72]; these two types of reports relate to various river basins. Eight different states, among them Alabama, California, Oregon, Pennsylvania, and Wisconsin, are represented by one or more reports presenting forecasts issued by state or regional planning agencies [38-50]. Oklahoma City, Providence, Greensboro, St. Louis, Los Angeles, Philadelphia, Detroit, Washington, and New Orleans are among the 28 different cities represented by reports presenting forecasts issued by city planning agencies.[1-37].

Several university bureaus of research or institutes have published reports containing forecasts; these reports are usually devoted to a description and analysis of population trends in a particular state or city (e.g., New Mexico, Michigan, California, Flint, Philadelphia) [73-83].

Only one report in the present study was published by a private business firm [85]. It is certain, as indicated earlier, that the true extent of the concern of private business with area forecasts is not reflected in the results of this study and that private business, in fact, makes extensive use of forecasts without publishing reports containing them. This is suggested by the correspondence on population forecasts which the Bureau of the Census receives. It is surmised that of the business organizations the utilities lead in active work in this field.

Forecasting by Federal Agencies. The official federal work in local area forecasting had a rather recent start and has been limited in volume. In 1934 Thompson and Whelpton of the Scripps Foundation for Research in Population Problems prepared a set of projections of state population (by residence classes) to 1960 for the National Resources Board by the cohort-survival method [66]. Two series were prepared for each state—one assuming zero net migration in future years and another making specific allowance for migration. Another comprehensive set of official state figures did not appear again until early this year when the Bureau of the Census published projections of state population to 1960 computed by the ratio method [70]. (This method essentially involves projecting the proportion which a given area constitutes of some larger area and applying this projected proportion to the total for the larger area, usually the United States forecasts already available.) Three series —designated low, medium, and high— were shown for each state.

As mentioned earlier, two federal agencies concerned with regional planning and development, the Federal Power Commission and the U. S. Office of Industry and Commerce, have been publishing forecasts for a series of areas in postwar years. The former agency has issued 14 power market surveys (with rather limited discussions of population prospects) [52-65], and the latter has issued or sponsored three economic base studies [51, 71-72], each giving projections to 1970 or beyond for the area under consideration. These areas do not correspond to any standard political or statistical areas, but represent combinations of counties as defined for the project at hand. Additional economic base studies are in preparation and will be released from time to time. The method

of forecasting generally used in the economic base studies is the ratio method, and in the power market surveys the method of labor force analysis. (The method of labor force analysis involves projecting the proportion of the population in the labor force and the total size of the labor force to a future year as a preliminary step in estimating total population.)

For the most part, the Census Bureau has eschewed entering the field of small area forecasting because of the lack of a tested and reliable method and has left it to outsiders. Moreover, with its always quite limited budget, it has never been possible for the Census Bureau even to consider undertaking the preparation of forecasts for areas smaller than states.

Several "unofficial" studies have been carried out by Bureau of the Census staff members. In the early forties Hauser attempted to classify the various metropolitan areas in terms of their chances of retaining their wartime growth in the postwar period.[6] These predictions were made on the basis of the consistency of the growth rates in each of these areas during the war period and the two preceding decades. No actual population forecasts were given, however. These studies represent interesting attempts at qualitative prediction on the basis of past trends. It would be interesting now to measure the success of these predictions against 1950 Census figures.

Another example of an "unofficial" study carried out in the Census Bureau, this one in collaboration with the U. S. Bureau of Agricultural Economics, is an article prepared early in 1951 by Margaret Jarman Hagood and the writer presenting projections of the population of the nine geographic divisions to 1975 [69]. The ratio method was used, and three series—low, medium, and high—were shown. The projections given in this article represent revisions of projections for the same areas previously published by the Bureau of Agricultural Economics[68].

It is probable that, because of the continuing responsibilities of various government agencies in the field of regional planning and the resulting demand for forecasts of this type, the Census Bureau or some other federal agency will continue to release forecasts from time to time for some or all of the regions or states. Possibly in time, with progress in methodological research and more adequate appropriations, the Census Bureau may consider this a regular part of its forecasts program.

Forecast Areas. It would be expected that the bulk of the forecasts in the study related to relatively small geographic areas. This was in fact the case, since out of the 130 forecasts or groups of forecasts for different types of areas shown in different reports, about one-fourth related to cities, one-fifth each to counties and metropolitan areas, and the remaining one-third to larger geographic areas. It is notable that city planning commissions were almost equally concerned with the central city and a more inclusive area, such as the county or metropolitan area.

Trend in the Number of Reports. It is surmised that the number of reports presenting area projections has been rapidly accelerating, at least in the last few decades. The classification of the reports included in the present study according to date of publication is suggestive. Of the 90 reports included in the study, 7 were published during the thirties, 19 between 1940 and 1945, and 64 in 1946 or after. Of the 22 federal re-

[6] Philip M. Hauser, "Population Shifts and Income Changes," *Marketing Series No. 52*, American Management Association, New York, N.Y., January 1943, and "Wartime Population Changes and Postwar Prospects," *The Journal of Marketing*, January 1944, pp. 238-247.

ports, 20 appeared since the end of World War II and 2 appeared earlier. A proliferation of such reports is anticipated in the years to come.

Length of Forecast Period. The number of years into the future for which forecasts are desired is a particularly important consideration. Both the selection of the method and the accuracy of the results are involved. For example, the few tests which have been made so far indicate, as expected, a considerable decrease in the accuracy of forecasts as the forecast period is increased.

The length of the forecast period (defined here as the number of years between the publication date and the date of the most distant forecast) was determined for the 90 reports in the study. Only 8 forecasts extended less than 10 years into the future, 25 extended 10 to 19 years, 46 extended 20 to 29 years, and 11 extended 30 years or more. Some forecasters display considerable daring. In 1945 the Milwaukee Planning Commission published a figure for Milwaukee County for the year 2000—a forecast of 55 years [14].[7]

With an average forecast period of 21 years shown by the study, it is evident that long-range forecasts are a frequent requirement, especially in public planning. If the study included more of the work of business firms, the average forecast period would very probably be lower since forecasts for sales planning purposes are more likely to be short-range. Sales planning, except in a few lines, need extend only 10 or so years into the future.[8]

[7] A more striking example is afforded by a report not included in the present study. In 1923 the New York City Planning Commission published a figure for the New York metropolitan area for the year 2100—a forecast of 177 years. See: Plan of New York and its Environs, *Predicted Growth of New York and its Environs*, by Raymond Pearl and Lowell J. Reed, New York, 1923.

[8] Margaret Jarman Hagood and Jacob S. Siegel, "Population Projections For Sales Forecasting," *Journal of the American Statistical Association*, September 1952, p. 526.

Methodology and Reliability

Types of Methods Found in Present Study. I do not propose to review here in detail the various methods of making small area forecasts or the specific problems attendant upon the use of one method or another. Although there is no single adequate presentation of the various methods giving details of computation, they have been described in several recent publications and illustrations of the application of the various methods may be found in many published reports.[9]

The important thing shown by the present study, perhaps is that, unlike the situation at the national level, a wide variety of methods has been used and no single generally acceptable method has as yet evolved. For the 90 reports included in the study the following methods were mentioned most frequently: the ratio method (16), the cohort-survival method (16), the simpler type of component method (14), and the method of labor force analysis (11). (The "simpler type of component method" refers to estimation involving separate allowance for births, deaths, and migration, but without taking age into account.) Other methods mentioned were graphic extrapolation and mathematical extrapolation (7), and generalized types of projections, such as of economic conditions, dwelling units, and students (9). In several cases, (6), an average of several methods was employed. The averaging procedure has the advantage of eliminating extreme errors, although some very good estimates may be worsened. In 11, or one-eighth, of the reports no methodological statement at all was given. Thus, about one-fifth of the reports which stated the method used employed the ratio method, and nearly two-fifths employed one of the component methods,

[9] See later section of this paper on "Aids to Forecasters."

either the cohort-survival method or the simpler type of component method.

A notable methodological fact which appeared in this study, apart from the variety of methods in use, was the frequency with which the method was not stated or stated inadequately. In only about three-fifths of the reports was the methodological statement complete or even adequate; in the other reports either no statement at all was given or it was vague or sketchy. This may be considered a serious deficiency of the presentation since it renders impossible any real interpretation of the results.

With the passage of time there seems to have been a distinct shift from mathematical and graphic methods to more analytic techniques, so that the various forms of mathematical and graphic extrapolation appear to be of secondary importance now. The ratio method is a rather recent development; it was first given prominence by Lorimer in the thirties.[10] As indicated by the present study, it is used quite widely today, being the basis of estimation in several recent federal reports. With important exceptions, the more technically oriented workers now tend to use one of the component methods. The cohort-survival method remains the exclusive property of demographers since it requires a knowledge of the use of life tables and other specialized demographic techniques.

Measurement of Reliability. Little has been done in the way of testing systematically the accuracy of small area forecasts and, in particular, of testing the relative reliability of various methods. For the most part, forecasters have been selecting a method on the basis of practical considerations or *a priori* judgments regarding the relative reliability of the methods with which they were familiar. Let us review the more important tests which have been made. The general design of these tests has been either to develop "forecasts" for past Census dates using data only from prior censuses and to compare them with the census figures, or to compare actual forecasts made by various estimators in earlier years with later census counts.

The early tests include those of Engelbardt in 1925, Houser in 1928, and Chamberlain and Crawford in 1932.[11] The latter two tests made use of actual forecasts already available rather than "forecasts" of the researcher's own making. Engelbardt compared the results of federal and state censuses with forecasts prepared by fitting a logistic curve and by the component method for a number of cities. The test was not systematic; average errors were not shown and only illustrative results are given. Houser took 59 reports of engineers issued between 1872 and 1922, many of them unpublished, and made 405 comparisons, involving forecasts for 119 areas for several census dates (made generally by mathematical or graphic methods). When the results as reported are corrected for errors in the statistical analysis, they show that the average error (disregarding signs) increased progressively from 6.3 percent for the 5-year forecasts to 33.8 percent for the 30-year forecasts. This study failed to take account of variations in method. Chamberlain and Crawford compared actual forecasts for 43 cities for 1930, classified into four groups according to method, with 1930 Census figures. They found an average

[10] National Resources Committee, *Suggested Procedures for Population Studies by State Planning Boards*, by Frank Lorimer, Washington, D. C., July 1938.

[11] Fred Engelbardt, *Forecasting School Population* (New York: Teachers College, Columbia University, 1925); G. C. Houser, "How Accurately Can Engineers Predict Future Population Growth of Cities?," *The American City*, September, 1928, pp. 124-126; and Leo M. Chamberlain and A. B. Crawford, *The Prediction of Population and School Enrollment in the School Survey* (Lexington: Bureau of Scoial Service, College of Education, University of Kentucky, March 1932). I am indebted to Robert C. Schmitt for calling these studies to my attention.

error of 17 percent for all the forecasts; the average error ranged from 12 percent for the 10 cities which used a component method to 39 percent for the 8 cities which used a correlation method. This study failed to take into account variations in length of forecast period.

A more systematic test was conducted by Schmitt and Crosetti in 1951 and was described in a recent issue of *Land Economics*.[12] It was a test of limited scope whose primary purpose was to measure the error in forecasts of the population of cities calculated by the ratio method, particularly as related to the length of the forecast period. Attention was also given to measuring the variation in the accuracy of ratio forecasts in relation to the form of the method (short and long forms), the type of area (city, standard metropolitan area), the size of city, and the city growth rate. Schmitt and Crosetti made 1940 and 1950 "forecasts" for 20 American cities from data up to 1930 and compared these forecasts with census figures for those years. The average error (disregarding signs) for the 1940 forecasts was 9 percent and for the 1950 forecasts 16 percent. Thus according to the test, 20-year forecasts are considerably less accurate than 10-year forecasts. Schmitt and Crosetti cite Segoe, a well-known city planning consultant, to the effect that 20-year forecasts should not be in error by much more than 10 percent if they are to be useful for planning purposes.[13] It was also found that accuracy was not closely related to the size of the city but that forecasts for rapidly growing cities tended to be more inaccurate than those for more stable cities. Forecasts for metropolitan areas were just about as accurate (or inaccurate) as those for their central cities. On the basis of this test, these researchers concluded that "the high degree of forecasting error characteristic of the ratio method indicates it to be of limited value to city planners."

In a subsequent number of *Land Economics* Loomer took issue with this study primarily on the ground that it assumed that the ratio method could be applied uniformly to a group of areas and that its reliability could be tested by evaluating the resulting forecasts.[14] He maintained further that, in practice, researchers consider rather carefully alternative methods before making a final selection and proposed as a fairer test of the method the measurement of the accuracy of those ratio forecasts which have been included in actual studies. In a rejoinder Schmitt stoutly defended the procedure used in his test and dramatically argued that the wide use of the ratio method reflected the present primitive state of population forecasting.[15]

Helen R. White recently conducted a test at the Bureau of the Census of the relative reliability of various methods of forecasting *state* population, involving the comparison of "forecasts" of her own making for 1940 and 1950, based on census data up to 1930, with Census figures for those dates.[16] The methods tested included the cohort-survival method (with and without migration), several variations of the ratio method, and three purely mathematical methods (arithmetic and geometric extrapolation,

[12] Robert C. Schmitt and Albert H. Crosetti, "Accuracy of the Ratio Method for Forecasting City Population," *Land Economics*, November 1951, pp. 346-348.

[13] Schmitt and Crosetti, *op. cit.*, p. 347.

[14] Harlan G. Loomer, "Accuracy of the Ratio Method for Forecasting City Population: A Reply;" *Land Economics*, May 1952, pp. 180-183.

[15] Robert C. Schmitt, "Accuracy of the Ratio Method: A Rejoinder," *Land Economics*, May 1952, pp. 183-184.

[16] Helen R. White, "Empirical Study of the Accuracy of Selected Methods of Projecting State Populations" (summary), *Population Index*, July 1952, p. 178.

and the apportionment method).[17] She concluded that although none of the methods tested was clearly superior to the others, the cohort-survival method (with an allowance for migration), the apportionment method, and one variation of the ratio method make the consistently best showings. She also found that the errors of forecasts tended to be larger for the areas with smaller populations and for the areas with larger migration rates in the recent past. For all methods combined, the average error for 1940—the 10-year forecast period—was 7 percent and for 1950—the 20-year forecast period —15 percent. For 1950, 54 percent of the forecasts were in error by 10 percent or more, and the average error exceeded 10 percent for each and every method. On the basis of this test as well as those mentioned earlier, it appears that the length of the forecast period is more significant than the choice of method in affecting the accuracy of the results.

Although Loomer appeared to be arguing with the fervor of a guilty defendant and I am strongly inclined to reject his criticism, I have attempted to carry out the kind of test for which he has asked, on the basis of the 90 reports included in the present study.

The practical difficulties in the way of conducting a valid test of this kind are many. They include: (1) The failure of the author of a report to specify or compute a best estimate when several projections are developed for a given date; (2) the inadequacy of the methodological statement given in a report or the numerous variations of a particular method which may be employed, rendering difficult or impossible the important classification in terms of type of method; (3) the failure of the author to present forecasts for the nearer dates; (4) the failure of the author to specify the actual base date of the forecasts, rendering difficult or impossible the important allowance for the length of the forecast period; (5) the failure of the author to define the area estimated precisely; and (6) the necessary use of forecasts in the test which vary both with respect to the identity of the area estimated and the method used. So far as the present test is concerned, (1), (3), and (5) appeared only occasionally and hence were not serious; (2) and (4), however, occurred quite frequently and represented major problems in the way of carrying out an adequate test, and (6) represents a major shortcoming of this type of test. To handle some of the difficulties listed, it was decided to include in the test only those forecasts for which the percentage error could be conveniently computed, to use the medium series of projections when several series were shown (or an average of the high and low projections when necessary), to disregard variations in the applications of a particular method, and to use the publication date in determining the length of the forecast period.

For the 99 forecasts for which comparisons with one or more census figures (1940 or 1950 in all cases) could be conveniently made, the average error was 8.4 percent, and more than a quarter of the errors were 10 percent or more. These are rather high figures in view of the fact that the forecast period was under ten years in all but a few instances and quite commonly under 5 years. The average error was 5.7 percent for the ratio method, 5.9 percent for the cohort-survival method, 10.3 percent for the simpler component method, 7.9 per-

[17] Arithmetic extrapolation and geometric extrapolation involve, respectively, the assumption of a continuation of the average annual amount and average annual rate of increase or decrease in the population as observed in some recent past period. In apportionment, total growth in a group of areas is prorated among the component areas in accordance with their previous relative growth (except that areas which previously lost population are assumed to remain unchanged).

percent for the method of labor force analysis, 9.4 percent for the remaining methods stated, and 6.5 percent for "method not stated." (The average errors given are in some cases greatly affected by a few large errors characteristic of the forecasts made by a single estimator.) Differences in the average length of the forecast period from method to method may have importantly affected the resulting pattern of average errors, however. The average error was found to be 7.6 percent for forecasts less than 5 years ahead and 9.6 percent for forecasts 5 or more years ahead. When only forecasts extending less than 5 years into the future are taken, the methods show less difference in average error. Less than one-fifth of the city and county errors were 10 percent or more, but more than one-half of the errors for metropolitan areas were of this size.

The tendency in the reports examined to underestimate future population is reflected in the fact that nearly two-thirds of the forecasts were lower than the Census figures. This type of bias appears to be characteristic of work done during the thirties and forties in the measurement of population growth to 1950. The opposite type of bias, however, may be characteristic of these same forecasts so far as population changes during future decades are concerned, as was probably the case with work done during the years before 1930 in the measurement of population growth to 1940.

One of the basic defects of the various tests made so far is that the results obtained are unique to the period selected for the test. This criticism is not intended to decry the usefulness of the tests made, but it does mean that many more tests are needed covering projection periods having widely different economic characteristics and growth trends. The results of the tests may therefore be regarded as only suggestive, not conclusive.

In addition to the reliability of the method selected for carrying the current population forward to a future date, the accuracy of a forecast of the population of a local area is dependent on the accuracy of the latest Census count for the area, the accuracy of the current estimate of the population used as a base in making the forecast, and (depending on the choice of method) the accuracy of national projections of population, birth rates, and death rates. It is probable that the error arising from these three sources is generally smaller than from actually projecting the population, but some attention should be given to them and more tests of reliability are needed. Evaluation of census data and of current estimates for geographic areas is now being undertaken in a much greater degree than formerly, and the methods of making current estimates are being revised accordingly.

The Range. One aspect of the questions of methodology and reliability is the matter of a range. Here again, the professional demographer and the practical consumer tend to part company. The former wants to express his humility and and caution by developing several series of projections; the other finds it necessary generally to work with a single best estimate. Public planners are presumably more willing to accept a range than sales forecasters. About one-half of the 90 reports included in the present study showed some type of range. Some, such as Thompson's report on Cincinnati [5], the 1946 report of the Detroit City Plan Commission [7], and Brown's study on California [84], presented an almost unmanageable number of series. I am inclined to favor the use of a range, particularly for long-term forecasts but

suggest that, in addition, the estimator show a single best estimate for the use of those who can work with only one number. Two series—a high and a low series—may be developed to define the range within which the true population is expected to fall with considerable likelihood; the medium series may be shown as the series of best estimates.

General Remarks on Methodology. Although no tested method is at hand for developing accurate forecasts, on the negative side certain things may be said. Some methods recommended and applied from time to time are of only limited value. The use of zoning regulations as a guide to the eventual peak population of an area, for example, may easily yield fantastic results, although this approach may be of value in some cases. In the *Progress Report of the Mayor's Committee on City Planning of New York City* published in 1936, it was noted that "New York City could house 76.7 million people without violating the height and area provisions of the zoning resolution" [20]. Use of a constant rate of growth, based on the experience of a single decade, over any considerable period of time into the future, may easily result in overstating or understating the population by a considerable amount, simply because the change in the single decade used as a base may reflect a unique phase in the area's growth. For example, at the rate of growth that Contra Costa County, California experienced between 1940 and 1950, it would grow from 299,000 in 1950 to 2,648,000 in 1970. The same general comment applies to the use of arithmetic extrapolation. These mathematical forms imply that a population may increase indefinitely or (in the case of arithmetic extrapolation only) become negative. It is suggested that, for long-range projections, if a mathematical method is used, the average rate or amount prevailing over a longer period than a decade, or the rates or amounts experienced during several past decades, be considered in extending the population.

Future research on methodology may most effectively be directed toward attacking the problem from a component point of view and, in particular, toward developing methods of predicting net migration. Not that the problem of predicting births and deaths has been solved! Certain general guides in the way of national projections exist for forecasting births and deaths at the local level, however, and national trends tend to be reflected in individual communities throughout the country. Net migration is a much more variable component than natural increase and may eclipse it at the local level. As is well known, the direction and volume of migration depend heavily on the relative economic opportunity in the various communities throughout the country. Migration operates as a type of adjusting force, albeit an imperfect one, in maintaining a balance between economic opportunity and population. A possibly fruitful avenue of research would seem to be to seek out economic and other series which have relatively high predictability or for which sound assumptions as to future trends can be made, and which can be correlated with past net migration. In this connection, account should be taken of the level of national income, the difference between per capita income in the nation and in the local area, and trends in the industrial and occupational structure of the community as compared with the nation as a whole. Relative economic opportunity is difficult to predict, and it is practically impossible to confidently assign exact quantitative values to one's judgments. More reasonable and useful results in population prediction should be secured, however, if the need for con-

sidering economic prospects, both nationally and locally, is first recognized.

Aids to Forecasters

The final section of this paper is devoted to a critical discussion of the various materials now available which provide guidance to those who must make as well as use forecasts. These materials consist of general reports or pamphlets specifically devoted to this problem, occasional or fugitive items of a general nature and, finally, reports which present forecasts and projections for specific areas.

An 80-page bulletin of the Department of Commerce entitled *Better Population Forecasting for Areas and Communities*, prepared by Van Beuren Stanbery of the Department's field staff, recently came off the press.[18] I recommend this bulletin to those of you who must make or use forecasts. The report provides both theoretical and practical guides. Part I discusses the various problems involved in making forecasts including the basic demographic facts and issues, the matter of the multiplicity of series, the range, and the role of economic factors. Part II describes the various techniques of forecasting and Part III gives a suggested procedure for making population projections. Part IV relates to special considerations for particular types of areas. Although I could take issue with many details in the report, it is essentially sound and should be used widely.

The bulletin entitled *Suggested Procedures for State Planning Boards* which Lorimer prepared for the National Resources Committee in 1938 remains a valuable contribution to the theory and practice of small area forecasting.[19] It describes and illustrates two methods in detail—the cohort-survival method and the ratio method.

Among the occasional and fugitive materials may be mentioned sections of various textbooks on planning, brief reports by planners, and articles in professional journals. In general, planning texts have not given adequate attention to the demographic aspects of planning.[20] *Local Planning Administration*, published by the International City Managers' Association in 1941 and republished in 1948, is a notable exception.[21] It is now widely used as a text in its field. It has a lengthy chapter on the basic demographic and economic studies required in local planning, and devotes several pages to population forecasting. The material on forecasting has a healthy cautious note. The United States Office of Industry and Commerce and the American Society of Planning Officials have each issued brief reports on population forecasting which are useful in spite of their occasional lack of preciseness.[22] Several general articles in professional journals have been referred to throughout this paper. The list includes articles by Schmitt and Crosetti, Loomer, Hagood and Siegel, Whitney, and Taeuber.

Perhaps the basic weakness of the treatment of the subject by most writers, is the failure to be as specific as possible regarding the reliability of the methods mentioned and to include the results of reliability tests. There is, in some cases, a tendency also to make dogmatic gen-

[18] United States Department of Commerce, *Better Population Forecasting for Areas and Communities*, by Van Beuren Stanbery, U. S. Government Printing Office, Washington, D. C., September 1952.

[19] Lorimer, *op. cit.*

[20] Robert C. Schmitt, "Demography and City Planning," *Social Forces*, April 1952, p. 302.

[21] The International City Managers' Association, Institute for Training in Municipal Administration, *Local Planning Administration* (Chicago, Illinois, 1941, ed. Ladislas Segoe, and 1948, ed. Howard K. Menhinick).

[22] United States Office of Industry and Commerce, "Short-Range Forecasting for Municipal Purposes," *Business Information Service*, by Victor Roterus and Robert C. Schmitt, April 1951; American Society of Planning Officials, "Population Forecasting," *Planning Advisory Service*, Information Report No. 17, August 1950.

eralizations regarding the relative accuracy of forecasts under various conditions. This is particularly true of the reports of city and regional planners.

Several of the reports presenting actual forecasts and projections have general expositions of the subject of forecasting and provide illustrative computations which are worth special attention. The report prepared by Thompson in 1945 for the Cincinnati Planning Commission is useful in both these respects [5]. The Hagood-Siegel article on "Regional Projections of the Population of the United States to 1975" (*Agricultural Economic Research*, April 1951) presents a general description of the various methods of preparing small area forecasts and describes in detail, with computing procedures, the variation of the ratio method used in preparing the regional projections given in the article [69]. Similarly, the recent Census Bureau report presenting state projections to 1960 (*Current Population Reports*, Series P-25, No. 56) contains a detailed exposition of the ratio method used [70]. The pamphlet on the future population of California prepared by Spurr and published by the Bureau of Business Research of Stanford University is interesting for its computation of forecasts by several methods, including a component method involving the use of correlation techniques [82]. Stanbery's reports on the population of California and Sacramento illustrate how economic factors may be taken into account [40-42].

Valuable guides may be obtained even from an examination of the more routine reports presenting forecasts. At the very least, they call attention to many of the practical problems involved in forecasting. My criticism of the reports presenting forecasts, as a group, reflects some of my suggestions as to procedures for developing forecasts and reporting them in published reports. The predictions are often entirely too positive and are not supported, first, by an adequate statement of the methods and assumptions used, and second, by an adequate statement of the rationale for selecting the particular methods and assumptions used. Sufficient attention is often not given to the role of economic factors and the economic assumptions underlying the forecasts made. Outmoded or indefensible methods, or out-of-date materials may be used. The possibility of developing several forecasts by a variety of carefully considered methods and then combining the results in a judicious way is often overlooked. This procedure serves both to check the soundness of any one of the forecasts and to eliminate extreme errors. Often either a great multiplicity of series of forecasts or a single series of forecasts is given in a particular report. The former is confusing to the users of the report and the latter gives too confident a view of future population size. It seems best, as mentioned earlier, to forecast the range (i.e., two extreme series —a high and low series) within which the population is likely to fall and to set down the best estimate expected to be realized within the range.

Finally, in view of the negative evidence so far regarding the superiority of the more elaborate over the simpler methods of making small area forecasts, it should be recognized that no insistent demand can properly be made at this time for the use of the more elaborate methods on the grounds of accuracy of results. Fortunately, since time and resources are usually quite limited, the simpler methods may do just as well. It should be recognized also, however, that the error of forecasts increases considerably as the length of the forecast period increases and that, in general, forecasts

extending more than 15 or so years ahead are subject to such substantial error that they are hardly adequate guides for carrying out practical programs.

Appendix

List of Reports Included in Study

(Reports listed below with titles indented show the same forecasts as the numbered reports listed immediately above them.)

City and County Agencies (Includes reports relating to the District of Columbia)

1. Arlington County, Department of Public Service, *Economic Survey of the Land Uses of Arlington County, Virginia*, by Homer Hoyt Associates, Arlington, Va., 1951.
2. Boston City Planning Board, *The People of Boston*, Volume II (*Population Trends*), Boston, Mass., August 1939.
3. Buffalo City Planning Commission, *Looking at Buffalo's Population in 1975*, Buffalo, N. Y., April 1949.
4. Chapel Hill Town Planning Board, *Population and Economy*, Chapel Hill, N. C., April 1949.
5. Cincinnati City Planning Commission, *The Population of Cincinnati Metropolitan Area*, by Warren S. Thompson, Cincinnati, Ohio, December 1945.
   Cincinnati City Planning Commission, "The Economy of the Cincinnati Metropolitan Area," *Cincinnati Metropolitan Master Plan Study*, December 1946.
6. Cleveland City Planning Commission, *The General Plan of Cleveland*, Cleveland, Ohio, December 1950.
7. Detroit City Plan Commission, "The People of Detroit," *Master Plan Reports*, 1946.
8. Detroit Metropolitan Area Regional Planning Commission, *Population Prospectus for the Detroit Region, 1960 and 1970*, by Paul M. Reid, Detroit, Mich., October 1950.
   Detroit Regional Planning Commission, *Projected Population for Detroit Region Development Areas, 1960 and 1970*, by Paul M. Reid, Detroit, Mich. December 1950.
9. District of Columbia, Budget Office, *Population Change and Governmental Planning in the District of Columbia*, Washington, D. C., May 1952.
10. Greensboro, N. C., Department of Planning, *Future Employment and Population in the Greensboro Metropolitan Area*, Technical Report No. 1, Greensboro, N. C. June 1948.
11. Kansas City, Missouri, Department of Research and Information, *Housing Market Analysis of Greater Kansas City*, Report No. 6, by W. D. Bryant, Kansas City, Mo., December 1945.
12. Los Angeles City Planning Commission, *Accomplishments 1949*, Los Angeles, California, 1950.
13. Milwaukee County Board of Public Land Commissioners, *Population Estimates for Milwaukee County*, by William L. Slayton, Milwaukee, Wisconsin, 1945.
14. Milwaukee County Regional Planning Department, *Population: Milwaukee County Wisconsin; Facts and Forecasts*, Milwaukee, Wisconsin, 1945.
15. Mobile City Planning Commission, *Housing Market Analysis*, Mobile, Ala., August 1945.
16. Modesto City Planning Commission, *Modesto Looks Ahead*, by Ali M. Ahmed, Modesto, Calif., December 1949.
17. National Capital Park and Planning Commission, *Washington, Present and Future*, Monograph No. 1, Washington, D. C., April 1950.
18. Newark, New Jersey, Central Planning Board, *A Preliminary Report on Past, Present, and Probable Future Population for Newark, N. J.*, No. 3, Newark, N. J., 1944.
19. New Orleans City Planning and Zoning Commission, *The Master Plan for New Orleans Population*, by Harland Bartholomew and associates, New Orleans, La., June 1949.
20. New York City, Mayor's Committee on City Planning, *Progress Report*, New York City, June 1936.
    New York City, Mayor's Committee

on City Planning, *Citywide Studies: Part 1.—Basic Factors in the Planning of the City of New York*, New York 1940.

21. Oklahoma City Planning Commission, *The Comprehensive City Plan*, Oklahoma City, Oklahoma, July 1949.
22. Omaha City Planning Commission, *Omaha, Nebraska—Chapter One: Population*, Omaha, Neb., March 1945.
23. Philadelphia City Planning Commission, *Estimates of Future Long-Term Trend of Population Growth in the Philadelphia-Camden Industrial Area, 1950-2000.* Planning Study No. 1, Philadelphia, Pa., April 1948.

    Philadelphia City Planning Commission, *Population Estimates 1950-2000, Philadelphia-Camden Area*, Planning Study No. 1, Second Edition, Philadelphia, Pa., March 1951.
24. Phoenix City Planning Commission, *Population Study and Forecast*, Phoenix, Arizona, 1947.
25. Providence City Plan Commission, *The Future Population of Providence, Rhode Island, 1940-1980*, No. 1, Providence, R. I., October 1945.

    Providence City Planning Commission, *Master Plan for Public School Sites*, Publication No. 7, Providence, R. I., March, 1950.
26. Rochester City Planning Commission, *A Study of Population Growth of Rochester and Monroe County*, Rochester, N. Y., December 1947.
27. St. Louis City Plan Commission, *Comprehenisve City Plan, St. Louis, Missouri*, by Harland Bartholomew, St. Louis, Mo., 1947.
28. Schenectady City Planning Commission, *The Comprehensive City Plan for Schenectady, New York*, by Harland Bartholomew and associates, Schenectady, N Y., September 1948.
29. Seattle City Planning Commission, "Population Forecasts for the City of Seattle by Census Tracts: 1970," *Current Planning Research*, No. 10, September 1952.
30. Seattle City Planning Commission, "Population Forecast, King County: 1960-70," *Current Planning Research*, Seattle, Washington, May 1952.
31. 79th Congress, 2nd Session, *Adequate Future Water Supply for the District of Columbia and Metropolitan Area*, House Document No. 480, United States Government Printing Office, 1946, pp. 11-25, 150-156.
32. Syracuse-Onondaga Post-War Planning Council, *Preliminary Report on Population Characteristics, Trends, and Prospects*, Syracuse, 1943.
33. Tacoma City Planning Commission, *Site—History—Population*, A Preliminary Report, Tacoma, Wash., May 1948.
34. Utica City Planning Board, *Comprehensive City Plan*, by Harland Bartholomew and associates, Utica, New York, March 1950.
35. Vancouver City Planning Commission and Housing Authority, *An Economic Analysis of Vancouver, Washington, and Its Environs*, Part I of the Vancouver Plan, by Bayard O. Wheeler, Vancouver, Wash., 1947.
36. Westchester County, N. Y., Department of Planning, *Westchester Population 1920-2000, Population Report 1*, White Plains, N. Y., July 1952.
37. Wichita City Planning Commission, *Wichita's Population, Its Background, Growth, and Future Pattern: The Basis of the Master Plan*, by Harland Bartholomew and associates, Wichita, Kansas, October 1943.

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39. California Population Commission, *California by 1950*, Sacramento, California, 1943.
40. California State Reconstruction and Reemployment Commission, *Forecasting a City's Future: Sacramento, California*, by Van Beuren Stanbery and Miriam Roher, Pamphlet No. 12, Sacramento, California, 1946.
41. California State Reconstruction and Reemployment Commission, *Estimates of Population Growth in California, 1940-1950*, by Van Beuren Stanbery, Ross Miller and George Sabagh, Sacramento, California, June 1944.

    V. B. Stanbery, "The Outlook for the Western States" in: Western Farm Economics Association, *Agriculture in Transition from War to Peace*, California, 1944.
42. California State Reconstruction and Reemployment Commission, *Estimated Range for Population Growth in California to 1960*, by Van Beuren Stanbery and Julian C.

Riley, Sacramento, Calif., November 1946.

43. Maryland State Planning Commission, *A Functional Plan for the Baltimore Metropolitan District*, April 15, 1948.
44. Massachusetts State Planning Board, "Population Study of Massachusetts-Summary," *A Planning Forum*, Vol. II, No. 4, March 1938.
45. Ohio State Planning Board, *Future Population of the State of Ohio*, Columbus,Ohio, 1937.
46. Pennsylvania State Planning Board, *The Population of Pennsylvania, Pennsylvania Planning*, Vol. 8, No. 6, Harrisburg, Pa., 1942.
47. Wisconsin State Planning Board, *An Analysis of Population Growth in Wisconsin*, Madison, Wisc., 1937.

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48. Pacific Coast Board of Intergovernmental Relations, "Estimates of Population of the State of Oregon for 1948-1960," *People, Jobs, and Income on the Pacific Coast, 1949-1960*, by Elon Moore and John F. Staehle, 1949.
49. Pacific Coast Board of Intergovernmental Relations, "Population in California in 1960," People, Jobs, and Income on the Pacific Coast, 1949.
50. Pacific Coast Board of Intergovernmental Relations, "A Century of Population Growth, State of Washington: 1860 to 1960," *People, Jobs, and Income on the Pacific Coast, 1949-1960*, by Calvin F. Schmid, Vincent A. Miller, and Horace William Mooney, 1949.

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51. Columbia Basin Inter-Agency Committee, *Population Projections for the Pacific Northwest States and Region: 1960 and 1975*, by Subcommittee on Comprehensive Program, July 1952. (Committee sponsored by the federal government)
52. Federal Power Commission, Bureau of Power, *Power Market Survey, Multiple Purpose Projects in Southwestern Region*, Dec. 1944, pp. 22-27.
53. Federal Power Commission, Bureau of Power, "Population," *Power Market Survey, Missouri River Basin, Power Requirements in Area A—Montana*, February 1949, pp. 19-20.
54. Federal Power Commission, Bureau of Power, "Population," *Power Market Survey, Missouri River Basin, Power Requirements in Area B—Wyoming—Colorado*, November 1947, pp. 16-19.
55. Federal Power Commission, Bureau of Power, "Population," *Power Market Survey, Missouri River Basin, Part I—Power Requirements, Area C—North Dakota*, November 1947, pp. 15-18.
56. Federal Power Commission, Bureau of Power, "Population," *Power Market Survey, Missouri River Basin, Power Requirements in Area D—Nebraska, Part I*, November 1947, pp. 23-25.
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58. Federal Power Commission, Bureau of Power, "Population," *Power Requirements Survey: State of Utah*, December 1946, pp. 74-77.
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60. Federal Power Commission, Bureau of Power, *Power Market Survey—State of Nevada*, February 1949, pp. 24-30.
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and Sex for the Mountain and Pacific Divisions, 1975, by Margaret Jarman Hagood and Louis Persh, December 2, 1947.

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    Texas Agricultural Experiment Station, *An Experiment in Research Planning*, Texas Conference on Population Research, November 1947.
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Book Reviews

Marx Against the Peasant: A Study in Social Dogmatism. By David Mitrany. Chapel Hill: University of North Carolina Press, 1951. pp. xvi, 301. $4.50.

This is an important book in the history of ideas. Its topic is the peasant doctrines and policies of Marxism, and their appalling consequences. The first part outlines the reasoning that led Marx to his pronouncement of doom for peasant agriculture, traces the course of this doctrine up to the Russian revolution, and records the appearance of the various peasant movements that arose to oppose it. The second part is a brilliantly concise account of the way in which the Soviets made tactical use of the peasants in the 1917 revolution, only to rob them of their cherished land in the collectivization drives after 1928. The third section describes the stunted flowering of the peasant movements of eastern Europe and of the associated land reforms that characterized the inter-war period. In the final section the author charts the tragic sequence of events that brought disaster to the peasant political movements and ensnared eastern Europe in the Soviet net. There are copious reference notes, and a good bibliography and index.

The economic bench-mark for this book is the Marxian conviction regarding the superiority of large-scale units in agricultural production. Drawing upon the England of the early industrial revolution for his experience, Marx the townsmen could see no hope for the future of peasant farming. The economies of scale were against it. More significantly, Marx could find no place in his system for the set of social values, with its emphasis on independence and the ownership of property, that is the essence of peasant agriculture. On economic grounds the peasant was doomed. On social and political grounds he had to be eliminated, for his continuing existence was a living contradiction of the Marxian ideas.

The controversy as to the economies of scale in agriculture goes on to the present day.[1] However else the argument may be resolved, the agricultural experience of the modern western world clearly does not bear out the Marxian prediction. The European peasant farm and the new-world family farm have proved to be remarkably durable institutions, on both the economic and social fronts. This experience the Communists must ignore, for their system cannot accept it. More than that, they must bend every effort to insure that it is not so. "Marx and Engels," Mitrany points out (p. 82) "on dogmatic grounds prescribed certain forms as right for the organization of agriculture; Soviet Marxism on political grounds exterminated several million peasants in the process of imposing by force, and with much loss and suffering, whatever the possible future benefits, the scheme of things assumed by Marx and Engels to be right; . . . . It does not prove that Marx and Engels were wrong, certainly not that they were right. It only proves the consistent dogmatism of Marxist argument and attitude on this subject."

The author performs a real service in setting forth a cohesive and succinct account of the rise of the peasant movements in eastern Europe. East of Italy and Germany the language becomes a true barrier to the English-speaking world. We understand much too little of the peasant struggle that has gone on in that area in the past century. Mitrany's description of the rise of Russian Populism and the variant forms this movement took in the rest of eastern Europe is one of the most useful accounts of this phase of modern agricultural history in the English language.

A major political disaster of our times has been the failure of Eastern Europe to produce indigenous political groups powerful enough to steer their agrarian countries between the rocks of industrial capitalism and Marxism.

[1] For penetrating, new light on this century-old controversy see John Brewster, "The Machine Process in Agriculture and Industry," *Journal of Farm Economics*, February 1950, pp. 69-81; Kenneth L. Bachman, "Changes in Scale in Commercial Farming and Their Implications," *Journal of Farm Economics*, May 1952, pp. 157-172.

This book goes far in explaining the roots of that failure. The peasants wanted land, and their parties were unanimous in demanding land reforms. Beyond that their aims were ill-defined. "Socialism had . . . . a set and confident doctrine before it had an organized following. The rousing of the political consciousness of the peasants, even if quickened by western influences, came later and it grew into a movement while its doctrine was still in the making." (p. 123) Indeed, much of the doctrine of "peasantism" has been propounded in recent years by party leaders in exile. One of the great questions that arises out of this book is: Do the peasant doctrines held by these groups still have validity? If democratic institutions are ever to gain foothold in eastern Europe, are these the doctrines that will call them forth? Even at the hands of as sympathetic an interpreter as David Mitrany the answers to these questions are not clear. What is clear is that the peasant emerges as the Marxists' *bête noire*. His power "lies not in action but in resistance." "The peasant is terrible," Mitrany quotes a Yugoslav official as saying. "What can you do with people who throughout five centuries of Turkish domination never ceased to regard it as anything but a stop-gap?" (p. 144).

The fateful split between the peasants and the non-Communist Social Democrats is carefully presented. Had they been able to join forces, the history of postwar Europe would almost surely have been quite a different, and a happier one. That they did not is a testament to the pervasive influence of Marxian peasant policy. While renouncing the Bolshevik brand of Marxism, the Social Democrats have been unable to break away from their doctrinaire Marxian belief in the superiority of large units in agriculture. The peasants wanted land; the Social Democrats wanted efficiency. In country after country this has thrown them into conflict with the peasantry, with disaster for both sides. No less doctrinaire in their Marxism, the Communists have nevertheless made tactical use of the peasants' land hunger. They have tortured the Marxian tenets when it suited their purposes, but they have been consistent in their tactics. This lesson the Social Democrats have not learned.

Throughout the book there is an elusive but unmistakable pro-peasant aura, with which it is impossible not to sympathize. Yet one suspects that the very qualities that have given the peasant durability in the face of unsurpassed oppression have also made him difficult to work with in the spirit of political compromise. The Marxists, whether Communists or Social Democrats, are not the only ones who cling tenaciously to outmoded doctrines. A recognition of this fact would not weaken Mitrany's argument and would give to it a balance that is now lacking.

The great topical importance of this book stems from the fact that Marxism has had to come to power through force in every instance. In almost all cases it has achieved or consolidated that power by riding on the backs of peasants. The exceptions (Soviet Germany, Czechoslovakia) are revealing, for even there the state reforms and policies of peasant neutralization were among the first major acts of the Communist regimes. One of the biting ironies of our times is that those Marxian groups who have sought to make the peasants' cause their own have been consecrated from the beginning to the peasants' ultimate destruction. Mitrany teaches this lesson in terms that leave no room for doubt.

This book bridges many disciplines. It has things of great value to say to the historian, the economist, and the political scientist; and it has some defects from their several points of view. It oversimplifies the political movements of eastern Europe in the past half-century; it probably will be judged to lack in detail and documentation by the historian; and its treatment of the economies of scale in agricultural production is far too scanty for the economists. If these defects were remedied we might have a less useful and certainly a less readable book. In its present lucid form it is indispensable in the study of the agrarian problems of countries now threatened with Communist domination. Although its focus is eastern Europe, there are basic lessons here for Asia, the Middle East, and Latin America. It is to be hoped that it will be widely translated.

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The Community of the Future. By Vinding Kruse. New York: The Philosophical Library, 1952. pp. 828.

A professor of jurisprudence at the University of Copenhagen who had previously

written some works in philosophy and in property theory has here put parts of them together and added further material in those fields as well as in the fields of legal theory and political and economic organization of society. The result purports to be a comprehensive guide for a personal and social philosophy.

The accomplishment, however, seems to me to fall short of the goal. The reader is several times led to expect, from the preliminary build-up on the solution of a particular problem, much more than is actually presented in the way of solution. Thus the first part of the book decries the "ethical nihilism" or ethical relativism which infects our scientifically minded era—the view that ethical or moral judgments cannot be scientifically validated—and suggests that the author's own "radical" analysis of the problem shows up the wrongness of this relativist position. But the author's analysis comes to this: that scientific method can help determine the extent to which the following of particular ethical precepts will result in achieving the ultimate purposes we deem desirable; that the ultimate purposes themselves—such as the preservation of mankind and the welfare of the individual—cannot be proved any more than the ultimate assumptions of natural science (though much, he says, can be derived from recorded human experiences and the insight of poets, religious teachers, etc.). Whatever else this may be, it can hardly be regarded as radical or novel.

Neither is much of a contribution made by the analysis of the fundamental principles of justice into four principles (pp. 150-1) (e.g., one is that men should "not injure each other without a higher social reason and [should] help each other in need"). Even if these principles were not too vague to be serviceable, they are surely not complete. So too with the principles stated as underlying notions of tort law (pp. 282-3).

I have the same criticism of his analysis of general jurisprudential conceptions; his classifications of types of personal and property rights; his analysis of the law governing industrial combinations; his proposal for a "court of industry" which is to control prices and wage agreements wherever cartels and unions have attempted to "dominate," and is to exercise numerous other powerful controls. The treatment throughout is altogether too sketchy, and perhaps inevitably so in an attempt to give definitive analyses and proposals in so many broad fields of philosophical and social thought. This sketchiness combined with a certain discursiveness of style make the work a less than satisfactory product—despite the author's obvious intelligence, good-will, and eclecticism.

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Announcement

THE LAND ECONOMICS FOUNDATION OF LAMBDA ALPHA, sponsored by the international land economics fraternity of Lambda Alpha, offers a prize of $500 for the monograph, thesis or book in the field of urban land economics (including real estate, research, planning, geography, and sociology) that is (a) adjudged best of those accepted by the graduate faculties of any university in the United States or Canada during the twelve months ending June 30, 1953 as a thesis in satisfaction of the requirements for a doctoral degree, and is (b) submitted for judging in the manner described below.

Students interested in submitting theses are invited to send outlines of their theses to the Trustees of the Foundation, who will then notify them whether the subject matter is within the field covered by the prize offer.

One copy of the completed thesis is to be sent to the Trustees postmarked not later than August 31, 1953, accompanied by a letter from the faculty certifying that the thesis has been accepted for a doctoral degree.

The thesis must not bear any name or mark identifying the author, and the manuscript must otherwise be set up without identification. The name and address of the entrant is to be listed only on the transmittal letter to the Trustees and on the faculty certification in order that the manuscripts will be completely anonymous when handed to the judges. All manuscripts will be returned to the entrants not later than November 1, 1953.

The judges, whose decision will be final, will be designated by the Trustees of the Foundation. They will be of diverse qualifications and will include at least one person engaged in the teaching of land economics and one person engaged in the business of real estate.

The winning essay or thesis will be known as "The Lambda Alpha Prize Essay in Land Economics for 1953." A typewritten manuscript of the prize essay is to be furnished the Foundation for its permanent files. The winner of the prize shall have the right to publish the thesis and retain all royalties.

If, however, the thesis shall not be thus published by November 1, 1954, Land Economics Foundation shall have the right to arrange for its publication, or reproduction, without expense to the author, in full or abbreviated form as a separate document or in an appropriate periodical.

Certificates of honorable mention may be awarded to others than the prize winner upon recommendation of the judges.
All communication should be addressed to:

Mr. Herman O. Walther, Chairman
Trustees of The Land Economics
Foundation of Lambda Alpha
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Chicago 4, Illinois